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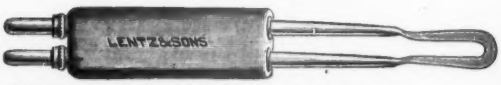

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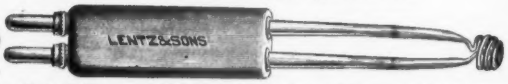

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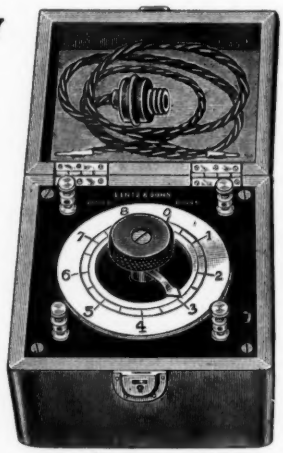

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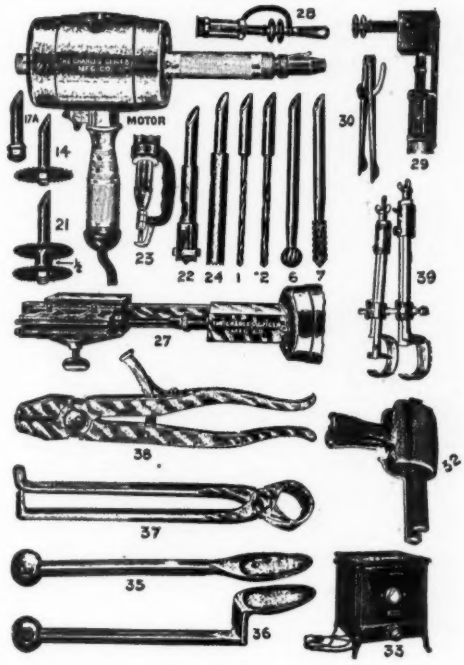

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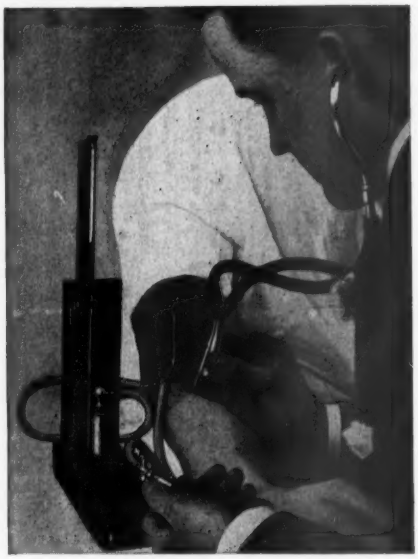

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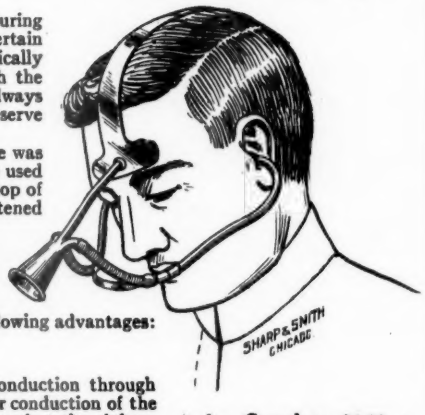

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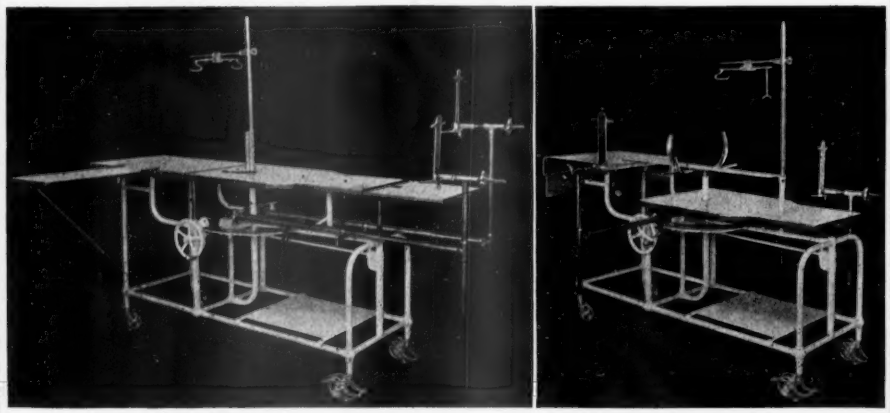

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VOLUME XXVII JULY, 1918 NUMBER 1

THE SURGERY OF THE DOUBLE KIDNEY

REPORT OF A CASE OF RESECTION OF UPPER SEGMENT FOR CALCULOUS PYONEPHROSIS

BY HUGH H. YOUNG, M.D., F.A.C.S., AND EDWIN G. DAVIS, M.D., BALTIMORE

From the James Buchanan Brady Urological Institute, Johns Hopkins Hospital, Baltimore

DURING recent years we have had in our clinic several cases of double kidney and ureter in which one portion of the double kidney was diseased. Only one of these cases has come to operation, and a careful study of the literature shows that although the condition is not very rare, its recognition and cure by operation is extremely rare. In fact, we can find no satisfactory report of any such case, and on this account it seems quite timely to report in full the following case in which a large branched calculus, occupying the upper half of a double kidney, was recognized and the condition cured by resection of the upper diseased half of the kidney with its special pelvis and ureter. Through the kindness of Dr. Franklin P. Mall, who placed at our disposal the complete series of embryos of the Carnegie Embryological Institute, and the assistance of Dr. George L. Streeter, we have been able to study the early embryology of the ureter and to make drawings and microphotographs which illustrate the development of this frequent and interesting anomaly.

History. The patient, a man of 57, was admitted on April, 7, 1916, to the James Buchanan Brady Urological Institute, complaining of a pain in the left flank. The pain was dull and aching in character, was increased by exertion, and had been present, with exacerbations and remissions, for ten years. There was no history of any attack resembling renal colic. He complained also of frequency of urination, voiding about every two hours by day and night. Pain in the back together with frequency and some burning on urination were his only symptoms. The patient could not name the exact date of onset but stated that symptoms had been present for at least ten years, during a great part of which time he had been unable to work. His family history and past history were unimportant.

Examination. The general physical examination was practically negative. The patient was a well-nourished, middle-aged man. With the exception of a few fine crackling râles audible on deep inspiration over the posterior base of each lung, no abnormality of the chest or abdomen was made out. Neither kidney could be felt, nor was there any tenderness in either kidney region. The urine showed a trace of albumin and a heavy sediment which, in the stained specimen, was seen to be made up of pus with numerous bacilli.

X-ray. Neither renal shadow was to be made out, but in the region of the upper pole of the left kidney was seen a large irregularly branching calculus, as shown in Figure 1. No shadow was seen in the region of the right kidney or of either ureter.

Cystoscopy and ureteral catheterization. There was no residual urine and the bladder capacity was normal. The cystoscope, which was easily inserted, showed a bladder mucosa somewhat reddened and inflamed throughout, and an elevated and thickened trigone. There was no stone or diverticulum. The ureteral catheters, which met with no obstruction, were passed up each ureter a distance of 15 centimeters. The urine obtained from the right catheter was macroscopically clear and the centrifuged specimen showed only a few red blood-cells, while that from the left was purulent. Phenolsulphone-

Fig. 1. Roentgenogram showing large, branching renal calculus, afterward found to be located in upper half of double kidney.

Fig. 2. Thorium pyelogram showing right bifid ureter and double kidney. Calculus in upper pelvis.

phthalein (6 milligrams injected intravenously) appeared on either side in four minutes, the output after thirty minutes being 20 per cent from the right side and 10 per cent from the left. The urea concentration in the urine excreted by the right kidney was twice that from the left.

Pyelogram. Thorium solution (15 per cent), prepared according to the method described by Burns (1), was injected by the gravity method through each ureteral catheter. The pyelogram showed, on the left side, a double renal pelvis with a bifurcation of the ureter at the level of the third lumbar vertebra, and about 9 centimeters below the lower pelvis (Fig. 2). The upper larger pelvis was completely filled by the calculus mentioned above. The lower pelvis was slightly smaller than normal and the calyces were not dilated. The pyelogram on the right side showed a normal pelvis with the exception of an apparent kink at the ureteropelvic junction, artificially produced by the ureteral catheter.

Diagnosis. Left bifid ureter with double pelvis and kidney; calculus in upper portion; lower portion probably normal. Right kidney normal.

Operation. Young. April 14, 1916. Under nitrous-oxide, oxygen and ether anæsthesia, the left kidney was exposed through an oblique lumbar incision. The lower portion of the kidney was found to be normal in appearance, a little larger than a half of a normal kidney, and only moderately adherent to the fatty capsule. The ureter coming from the lower portion or segment was easily exposed and was found to be slightly dilated and thickened. The upper segment of the kidney, which was exposed with some difficulty on account of dense adhesions to the fatty capsule, was much larger than the lower, was nodular and inflammatory, and through the thin shell of renal tissue could be felt a large, irregularly shaped calculus, almost entirely filling the interior. Demarcating the two portions of the kidney was a slight but distinct furrow, the upper and lower portions of the kidney being quite different in appearance. Figure 3 shows the kidney exposed. In order to avoid the danger of injury to the vessels of the lower normal portion, by attempting to dissect the dense fibrous mass which constituted the pedicle and which surrounded the blood supply of both portions, the operator divided and ligated only a small portion of the upper part of the pedicle, and then made a transverse incision through the kidney just above the junction of the two segments, not cutting into the normal kidney tissue (Fig. 4). After this it was a comparatively simple matter to isolate and ligate the entire blood supply to the upper segment. A moderate amount of bleeding from the cut surface of the remaining kidney tissue was effectually controlled by placing four mattress sutures of catgut, and tying while the edges were approximated between the thumb and forefinger, as shown in Figure 5. After division and ligation of its ureter about 0.5 centimeters above the point of bifurcation, the upper diseased segment was removed, leaving *in situ* a normal half kidney with undisturbed blood supply, pelvis, and ureter. The incision was closed with catgut and drained. The patient stood the operation well.

Pathology. Examination of the specimen removed showed that it consisted of a mere thin-walled sac of fibrous tissue, microscopical sections from which showed a complete absence of kidney tubules. Almost entirely filling the sac was a large branching calculus shown in Figure 6.

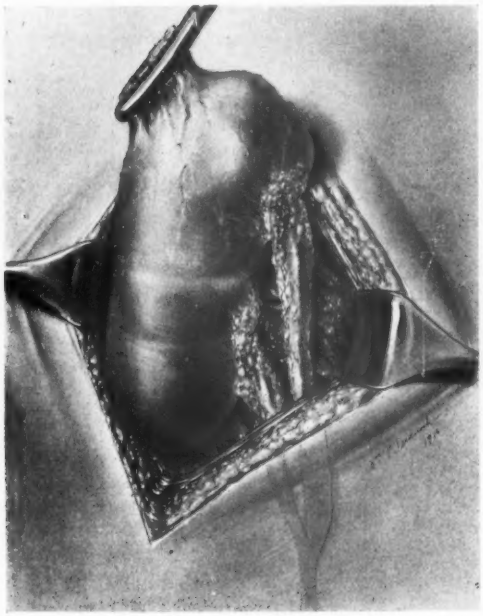

Fig. 3. First stage of operation, showing the double kidney exposed. The upper large pyonephrotic portion is demarcated from the lower normal portion by a furrow. The point of bifurcation of the ureter is diagrammatically indicated in dotted lines.

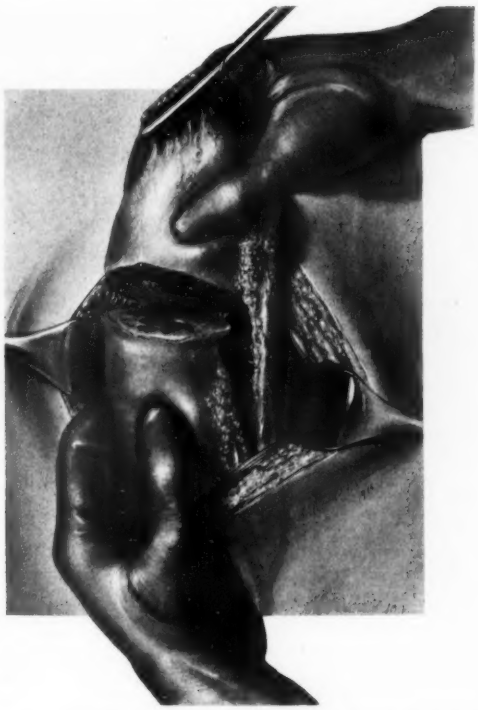

Fig. 4. Second stage of operation. The two segments of kidney tissue have been separated by a transverse incision just above the level of the furrow.

Postoperative history. The immediate convalescence was uneventful. On the twelfth day the last drain was removed, leaving a small narrow sinus which persisted, with a scant mucoid discharge, until the thirty-fourth day, when a urinary fistula developed. On the following day the patient's temperature rose to 103° and remained irregularly elevated for three days, then returning to normal and remaining so, the urinary drainage ceasing on the day after the temperature dropped. Two weeks later, the patient was discharged from the hospital with the incision entirely healed and the temperature normal. Urine examination at this time showed still a trace of albumin and only a very few pus-cells. A thorium pyelogram made on the day of discharge showed, on the left side, a pelvis slightly smaller than normal and with normal calices; just as before operation (Fig. 7). The stump of the excised ureter was not visible. The phenolsulphonephthalein test showed a secretion of 3 per cent from the left side in half an hour, and 15 per cent from the right. The urine from the right side was clear, while that from the left still showed a few pus-cells and bacilli.

On August 10, four months after operation, the patient returned for examination. His general condition was excellent, he was entirely relieved from symptoms, and able to resume his work. Ureteral catheterization done at this time showed a clear, uninfected urine from each kidney. The phenolsulphonephthalein output after thirty minutes was 20 per cent from the right side and 5 per cent from the left.

FREQUENCY AND SURGICAL IMPORTANCE OF RENAL ANOMALY

Anomalies of the kidney and ureter occur more frequently than is generally appreciated, and among such kidneys a relatively large number show pathological changes. In other words, malformation predisposes to disease. Botez (2) demonstrated this by a statistical study. Basing his calculation upon 51,504 autopsy records, he found the frequency of horseshoe kidney to be 1 in 715, while in a series of 1000 kidney operations the proportion was 1 in 143, a percentage five times as great. From this he concluded that a horse-

Fig. 5. Third stage of operation. The diseased segment has been removed, its ureter ligated and hæmorrhage from normal portion controlled by mattress sutures.

shoe kidney is more apt to become diseased than a normal kidney. Robinson (3), among

Fig. 7. Thorium pyelogram made after removal of upper calculous pyonephrotic portion of double kidney. Contrast with Figure 2.

Fig. 6. Calculus after removal from upper half of double kidney.

fifty collected specimens of duplicate ureter, found that hydroureter (of one ureter) occurred in 24 per cent. In a series of 24 cases of explored double kidney and ureter, to be cited below, the pathological process was located in the upper kidney segment in 19 instances. Judging from this uneven percentage it is fair to assume that partial obstruction of the superior ureter, due to its position with respect to the lower kidney segment and to the kidney pedicle, had been an important factor in producing disease. Girard (4), among 44 cases of ectopic kidney, found 21 hydronephroses. An idea as to the frequency of renal anomaly may be obtained from the studies of Naumann (5), who found 100 anomalous kidneys in a series of 10,177 autopsies; about 1 per cent. This series included only gross renal anomaly, such as fused, ectopic, cystic, atrophic, and lobulated kidney. Anomalies of the renal vessels are very much more frequent. Papin (6), in examining a series of 324 kidneys, found 64 (exactly 20 per cent) in which there were at least two renal arteries. If 20 per cent of all kidneys possess anomalous arteries, the percentage of individuals with anomalous renal arteries must necessarily be still higher. For a splendid review of the entire subject,

Fig. 8

Fig. 9

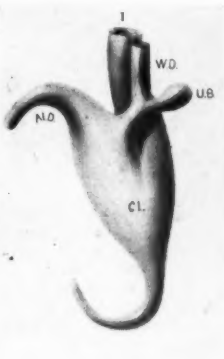

Fig. 10

Fig. 8. Cloaca of a 3 millimeter human embryo. The wolffian ducts have not yet developed in this region. *Al. D.* Allantoic duct; *I*, intestine; *Cl.* cloaca. (After model by Keibel.)

Fig. 9. Cloaca of a 4.2 millimeter human embryo. The wolffian ducts have appeared, and enter the cloaca on either side. *Al. D.*, Allantoic duct; *I*, intestine; *Cl.* cloacal membrane; *W. D.*, wolffian duct. (After model by Keibel.)

Fig. 10. From a 6.5 millimeter human embryo. The ureteral bud is seen springing from the wolffian duct close to its opening into the cloaca. The separation of the cloaca into intestinal and urogenital portions by the urorectal septum has begun. For the sake of clearness, the right wolffian duct has been omitted in this drawing and in those following. *Al. D.*, Allantoic duct; *I*, intestine; *Cl.*, cloaca; *W. D.*, wolffian duct; *U. B.*, ureteral bud. (After model by Keibel.)

dealing with the importance and the frequency of the various forms of renal and ureteral malformation, and including an extensive bibliography, the reader is referred to the complete work of Adrain and Lichtenberg (7).

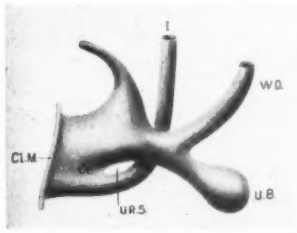

Fig. 11

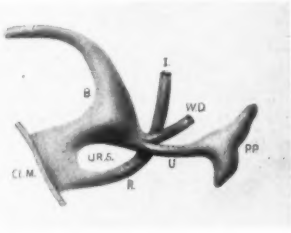

Fig. 12

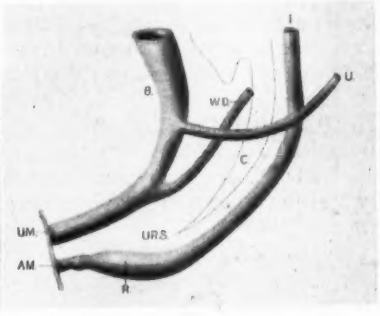

Fig. 13

Fig. 11. From 7 millimeter human embryo. The urorectal septum has separated the cloaca into two distinct portions, the wolffian duct opening into the anterior portion. The lower end of the wolffian duct has become dilated. *Cl. M.*, Cloacal membrane; *Cl.* cloaca; *I*, intestine; *W. D.*, wolffian duct; *U. B.*, ureteral bud; *U. R. S.*, urorectal septum. (After model by Felix.)

Fig. 12. From an 11.5 millimeter human embryo. The urorectal septum has almost reached the cloacal membrane. The tip of the ureteral bud has become bulbous, and shows a distinct tendency toward bifurcation. The wolffian duct and the ureter have acquired separate openings into the bladder side by side. *Cl. M.*, Cloacal membrane; *B.*, bladder; *U. R. S.*, urorectal septum; *R.*, rectum; *I.*, intestine; *W. D.*, wolffian duct; *U.*, ureter *P. P.*, primitive pelvis. (After model by Keibel.)

Fig. 13. From a 25 millimeter human embryo. The urorectal septum has reached the cloacal membrane, completely dividing the cloaca into bladder and rectum. The dotted line indicates the limit to which the cœlom descends, the two layers of this peritoneal pouch later becoming fused to form Denonvilliers' two-layered fascia. The ureter and the wolffian duct have acquired separate orifices, and the latter has shifted downward and later becomes the ejaculatory duct. *U. M.*, Urogenital membrane; *A. M.*, anal membrane; *B.*, bladder,; *R.*, rectum; *W. D.*, wolffian duct; *U. R. S.*, urorectal septum; *C.*, cœlom; *I.*, intestine; *U.*, ureter. After model by Keibel.)

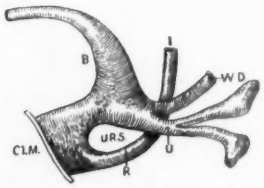

Fig. 14. Schematic representation of a bifurcation of the primitive pelvis in excess of the normal bifurcation shown in Figure 12. It can readily be understood that a dilatation of the lower end of this cleft ureter would produce two separate ureteral orifices in the bladder. *Cl. M.*, Cloacal membrane; *B.*, bladder; *U. R. S.*, urorectal septum; *R.*, rectum; *I.*, intestine; *U.*, ureter; *W. D.*, wolffian duct.

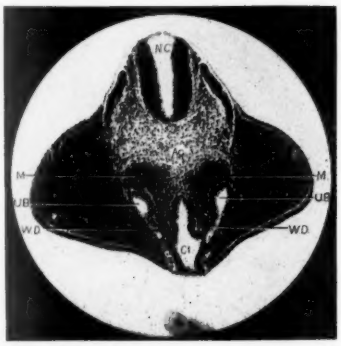

Fig. 15. Cross section through caudal end of a 6 millimeter human embryo, showing both wolffian ducts entering cloaca and both ureteral buds given off from the wolffian ducts just at the angle where the latter turn and run cranially. Figure 10 shows how a cross section at this level would cut the wolffian ducts longitudinally. *M.*, Mesonephrogenic cells; *U. B.*, ureteral bud; *W. D.*, wolffian duct; *N. C.*, neural canal; *Cl.* cloaca. (Embryo, Mall 988, slide, 6, row 7, sec. 3.)

Ureteral duplication, with double pelvis and kidney, is surprisingly common. It occurs more frequently than all the other forms of gross renal anomaly taken together. Poirer (8), Wagner (9) and Bostroem (10) independently concluded that 3 per cent of all individuals have double or bifid ureter, while Robinson found six instances in one hundred consecutive autopsies. As early as 1878 Weigert (11) had noted the frequency of this anomaly and stated that "more than one case" occurred in every hundred. Four cases of double ureter, out of 165 dissections, were reported by Kerr (12). In examining 60 human embryos, Pohlman (13) found two instances of double ureter, the embryos being 13 and 24 millimeters in length respectively. The condition, therefore, is one which every urologist is certain to encounter, and which should be diagnosed before operation either by cystoscopy or pyelography, in many of the cases.

EMBRYOLOGICAL DEVELOPMENT

In considering the formation of double ureter it is of interest to review briefly the facts known about the early development of the ureter and kidney from the wolffian duct. It will be remembered that during the embryological development of the higher vertebrates, three successive types of excretory organ (pronephros, mesonephros and metanephros) are formed in the order named, the first two being provisional or temporary, and the third becoming the permanent kidney. All three are of mesodermal origin, being derived from the nephrotomes or primitive segment stalks, a series of mesodermal cell masses extending longitudinally on either side of the neural canal, and lying between the primitive segments and the lateral mesodermal plates. Considered as a whole, these primitive segment stalks make up the nephrogenic cord, the parent structure of all three excretory organs. After the formation of the pronephros, which early takes place from its cranial portion, the nephrogenic cord becomes divided into mesonephrogenic and metanephrogenic portions, the former giving rise to the wolffian body and the latter, the caudal portion, being destined to form the secreting portion of the permanent kidney.

The pronephros in some of the lower vertebrates is well developed and is the permanent and only excretory organ, while in mammals it is quite rudimentary and may be demonstrated for only a very short period during the life of the embryo. Although its presence in the human embryo is very transient, it has been definitely shown that it exists (Felix, 14), that it occurs only in the region of the first twelve primitive segments, that its development begins before the embryo has reached the 2 millimeter stage, and that it has undergone complete atrophy (except for its duct, the primary excretory duct) by the time that the embryo has reached a

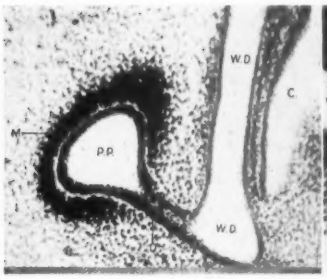

Fig. 16

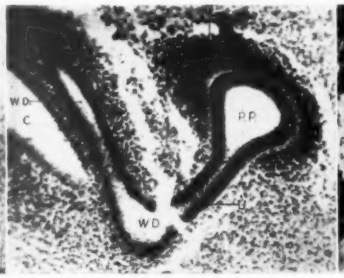

Fig. 17

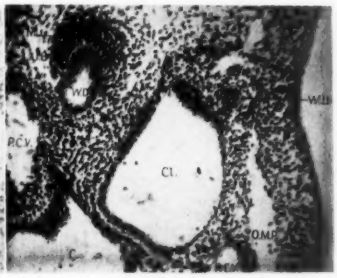

Fig. 18

Fig. 16. Sagittal section through a 7.8 millimeter human embryo, showing in an almost diagrammatic manner the wolffian duct with its ureteral bud terminating in a bulbous swelling, the primitive pelvis. Surrounding the latter is a zone of metanephrogenic tissue, clearly differentiated from the surrounding mesoderm. *M.*, Mesonephrogenic cells; *P. P.*, primitive pelvis; *W. D.*, wolffian duct; *U.*, ureter; *C.*, cœlom. (Embryo, Mall 1354, slide 5, row 3, sec. 2.)

Fig. 17. Sagittal section through a 6.6 millimeter human embryo, showing another almost diagrammatic picture of the ureteral bud. This section, and the one from which Figure 16 was taken, fortunately happened to be in exactly the right plane to cut both wolffian duct and ureter longitudinally. *W. D.*, wolffian duct; *C.* cœlom; *M.*, mesonephrogenic cells; *P. P.*, primitive pelvis; *U.*, ureter. (Embryo, Mall 371, slide 5, row 3, sec. 5.)

Fig. 18. Cross section through cloaca and both wolffian ducts of a 6.5 millimeter human embryo. One wolffian duct shows a ureteral bud very early in the progress of evagination. Note that although the distance which the ureteral tip has grown is less than the diameter of the wolffian duct, the former is already surmounted by the "cap" of metanephrogenic cells. *M.*, Mesonephrogenic cells; *U. B.*, ureteral bud; *W. D.*, wolffian duct; *P. C. V.*, posterior cardinal vein; *C.*, cœlom; *Cl.*, cloaca, *O. M. P.*, omphalomesenteric plexus. (Embryo, Mall 800, slide 22, row 3, sec. 2.)

length of 5 millimeters. It has no function and is of importance only in that its duct persists to form the wolffian duct, the excretory duct of the mesonephros.

The mesonephros or wolffian body, arising from the primitive segment stalks from the fifth cervical to the third lumbar segments (the mid-portion of the nephrogenic cord), and consisting of a series of glomeruli and tubules opening into a common efferent duct, is the

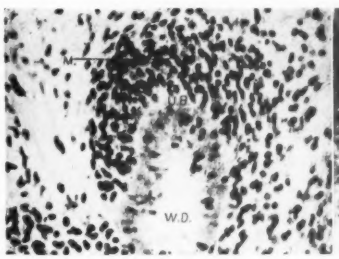

Fig. 19

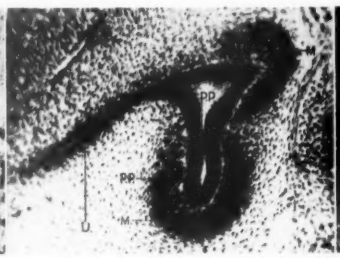

Fig. 20

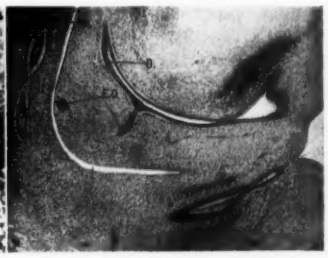

Fig. 21

Fig. 19. Higher magnification of ureteral bud shown in Figure 18. Note the sharpness and clearness of the stain of the nuclei of the metanephrogenic cells in contrast with those of the surrounding mesoderm. *M.*, mesonephrogenic cells; *U. B.*, ureteral bud *W. D.*, wolffian duct.

Fig. 20. Sagittal section through a 10 millimeter human embryo, showing distinct bifurcation of primitive pelvis. This bifurcation may be shown to take place as early as the 8 millimeter stage, although it happened that none of the 8 millimeter embryos studied were sectioned in the correct plane to demonstrate the bifurcation in a single, clear-cut, diagrammatic picture, as the above section from a 10 millimeter embryo supplied. *U.*, Ureter; *P. P.*, primitive pelvis; *M.*, mesonephrogenic cells; *Ao.*, aorta. (Embryo, Mall 1197, slide 12, row 1, sec. 2.)

Fig. 21. Sagittal section through the cloacal region of a 23 millimeter human embryo, showing cloaca completely separated into urogenital and rectal portions by the urorectal septum. A pouch of peritoneum (*C*) is seen extending well down beyond the point of entrance of the ejaculatory duct (wolffian duct) into the future urethra. It is these two layers of peritoneum that later fuse to form Denonvilliers' fascia. *I.*, Intestine; *C.*, cœlom; *E. D.*, ejaculatory duct; *B.*, bladder; *R.*, rectum; *An.*, anus. (Embryo, Mall 453, slide 24, row 1, sec. 1.)

Fig. 22. Bilateral renal calculi; large branching calculus filling pelvis and calices of right kidney and also the pelvis and calices of the upper portion of the left kidney, which is double. The lower portion of the double kidney is normal. X-ray plate (as indicated) showed a shadow in the right kidney but none in the left because the plate was placed too low. (Case of H. H. Young.)

permanent excretory organ in certain fishes and amphibians but undergoes atrophy in man. Its duct, the mesonephric or wolffian duct, opens into the cloaca (the blind caudal extremity of the intestinal tract) which it reaches at about the 4 or 4.5 millimeter stage of embryonic life, as shown in Figures 8 and 9. Felix considers that in man the mesonephros does not function as an excretory organ because it is well on its way toward degeneration before the metanephros, or permanent kidney, has sufficiently developed to assume any excretory function that the former might have had. The mesonephros is at the height of its development during the fourth and fifth weeks of embryonic life (Kelly and Burnam, 15) and undergoes atrophy from the eighth to the sixteenth weeks, the duct persisting as the vas deferens in the male and being rudimentary in the form of Gaertner's duct in the female.

The anlage of the metanephros or permanent kidney appears (in an embryo of about 5 millimeters) as a budding or evagination from the lower end of the wolffian duct close to its opening into the cloaca, as shown in Figures 10, 15, 16, and 17. The stage of renal development, however, corresponds only approximately to the external measurements of the embryo, and therefore embryos larger than 5 millimeters may show no evidence of ureteral buds. Such was the case in embryos 1075 and 873 of the Mall collection, each of which measured 6 millimeters. This bud is destined to form the ureter, pelvis, calyces, and collecting tubules, that is, the entire efferent apparatus, while the secreting portion of the kidney, including Bowman's capsules, convoluted tubules, and ascending and descending loops of Henle, is derived from a mass of mesodermal cells forming the so-called metanephrogenic tissue which, as stated above, has its origin from the caudal portion of the nephrogenic cord. This mass of cells surrounds the tip of the ureter very soon after its evagination, even before the bud has grown a distance equivalent to the diameter of the wolffian duct, and is shown in Figures 18 and 19, the nuclei staining very deeply in sharp contrast with the surrounding mesoderm. These specialized mesodermal cells are also shown in Figures 16 and 17 and are seen to form a distinct, almost diagrammatic, mesodermal "cap" covering the bulbous tip of the ureteral bud. The ureteral bud grows at first dorsally toward the vertebral column and then turns and grows cranially, the tip being surmounted or capped by the mass of metanephrogenic cells which accompanies it in its ascent. As early as the 6.6 millimeter stage the ureteral tip has become bulbous, the primitive pelvis thus being differentiated from the more slender stalk, the future ureter (Figs. 12 and 20). A continued process of outgrowth and branching produces the complete system of calyces and collecting tubules. During the ascent of the kidney, changes are taking place in the region of the lower end of the ureter. By a gradual downgrowth of the urorectal

septum, which first appears as a saddle-like depression between the allantois and intestine, the cloaca becomes divided into urogenital and intestinal portions; the future bladder and rectum. The series of cloacal models shown in Figures 8, 9, 10, 11, 12 and 13, indicates the various stages by which the cloaca becomes divided into separate portions by this coronal septum, which finally reaches the cloacal membrane, dividing the latter into urogenital and anal membranes. The septum passes posterior to the orifices of the wolffian ducts so that the latter come to open into the urogenital portion. Figure 21, which is a sagittal section passing through the bladder and rectum of a 23 millimeter embryo, shows that a pouch of peritoneum (C) extends down into the urorectal septum to a point well beyond the entrance of the wolffian ducts (ejaculatory ducts) into the urethra. This peritoneal pouch subsequently becomes obliterated, and its identical position comes to be occupied by Denonvilliers' two-layered fascia, which in adult life intervenes between prostate and rectum and is of such great surgical importance, both as a cleavage plane in perineal prostatic and seminal vesicle operations, and as a barrier in limiting the extent of malignant disease of the prostate. As early as 1837 Denonvilliers (45) wrote an excellent anatomical description of this fascia, although he did not understand its embryological significance and evidently did not recognize the existence of more than one layer. By a process of dilatation, as shown in Figures 11 and 12, the lower end of the wolffian duct comes to form a portion of the wall of the future bladder, the ureter thus acquiring an orifice separate and distinct from that of the wolffian duct, which shifts downward and later becomes the ejaculatory duct (Fig. 13).

We have stated above that, at about the 8 millimeter stage, the blind bulbous tip of the ureter (the primitive pelvis) normally splits into upper and lower divisions, the first evidence of the calyces (Figs. 12 and 20). There is a general agreement among authors that the formation of incomplete double ureter may be accounted for by a premature or exaggerated bifurcation of the tip of the ureteral bud, the split extending varying distances down the ureteral stalk instead of being confined to the bulbous tip or primitive pelvis (Fig. 14). Felix describes this as a "precocious splitting of the ureter," the bifurcation taking place before the formation of the primitive renal pelvis, and the two ureters thus formed ascending parallel to one another. He designates such forms of ureter as "cleft ureter," reserving the term "double ureter" only for those that have separate openings in the bladder. We have seen no case of partial ureteral duplication in which the portion of the ureter nearest the kidney was single and that nearest the bladder double, nor have we found records of any such case either in the pathological or the surgical literature. It would be difficult to explain such a condition embryologically.

Concerning the origin of complete double ureter there is some difference of opinion. Felix considers that such ureters must necessarily arise as separate outbuddings from the wolffian duct. According to Pohlman, the bifurcation may take place so close to the wolffian duct that the two ureters acquire separate orifices through the process of dilatation of the caudal end of the wolffian duct, by which process the latter becomes a part of the bladder wall. Huntington (16) cites a case of bifid ureter with one "perfectly formed pelvis and primary and secondary calyces," and the other pelvis incomplete. He considers that since this normal pelvis could have arisen only as the result of a normal development of a normal ureteral bud, the second ureter and pelvis must, therefore, have arisen as a lateral sprout from the main ureteral stem. It may be stated as a general rule that, in case of complete double ureter, the ureter which has its orifice lowest in the bladder drains the higher renal pelvis, as was pointed out by Weigert as early as 1877. In cases of resection of a portion of the double kidney this crossing of the ureter would be of surgical importance.

ANALYSIS OF CASES IN LITERATURE

Excluding the numerous reported cases of bifid or double ureter demonstrated by autopsy or dissection, and those demonstrated

by cystoscopy and by examination of the external genitalia, we have been able to find in the literature, in addition to the case we are reporting at present, twenty-nine instances in which this form of anomalous kidney was operated upon. We have been able to find only the briefest reference to two of these (cases of Eisendrath and Israel) and therefore can give no details. The remaining twenty-seven all showed complete duplication of the renal pelvis, and grades of ureteral duplication varying from a bifurcation close to the kidney to a complete supernumerary ureter with a separate orifice; and all but two were operated upon because of a pathological process located in the anomalous kidney. In the two exceptions, cases of Stammler and Josephson, the operation was undertaken merely on account of the incontinence produced by the supernumerary ureter opening externally, there being no lesion in the kidney itself.

Josephson's (17) patient was a girl of eighteen who had had incontinence since birth due to a supernumerary ureter opening near the external urethral orifice. After a correct diagnosis he was able to cure the incontinence by exploring a left double kidney and resecting the upper portion which was about "the size of a hen's egg," leaving *in situ* a lower normal portion the size of a normal kidney. In Stammler's (18) case there was bilateral double ureter, each anomalous ureter opening into the vagina, and, in accordance with Weigert's rule, draining the upper pelvis of a double kidney on either side. Both kidneys were explored. On the right side the anomalous ureter was sectioned and ligated and the two renal pelves anastomosed. On the left side an anastomosis was considered inadvisable on account of the small size of the upper pelvis, and therefore a part of the upper half of the kidney was resected. The incontinence was cured.

In all of the remaining twenty-five cases the operation was undertaken on account of a pathological condition which was primarily confined to one segment of a double kidney, and in all but four (Lange, 19; Chute, 20; Linck, 21; Pilcher, 22) the remaining segment was normal at that time of operation. There were seventeen cases of pyonephrosis (four complicated by stone), four of tuberculosis, three of hydronephrosis and one of "acute surgical kidney" (Lange). It is of interest to note that in nineteen instances (practically 80 per cent), the pathological condition was located in the upper segment. In four the lower segment was involved, in another, both segments, while in the remaining one the seat of the disease was not mentioned. In two instances (Steiner and Franke) the operation was pyelotomy. Steiner (23) drained a pyonephrotic sac involving the lower portion of a double kidney. Franke (24) drained a hydronephrosis of one pelvis of a double kidney and divided an anomalous artery which was the cause of the obstruction. In Scudder's (25) case, that of a child twenty months old, there were acute symptoms produced by a huge, dilated, supernumerary ureter which ended blindly. Merely an exploratory operation was done, the child dying soon afterward.

The possibility of an erroneous diagnosis due to an anomalous ureter is nicely shown by the case reported by one of us (Young, 26) in 1903. The patient, a man of 54, with a history of pyuria of several years' duration, and who had had one attack of left sided renal colic with passage of calculus two years before admission, showed, as a result of ureteral catheterization clear normal urine from the left kidney and purulent urine, from the right. The X-ray plate showed a large calculus in the region of the right kidney with no shadow on the left. With a negative X-ray examination and normal urine from the left side, the conclusion was that the left kidney was normal, and therefore a right nephrotomy with removal of calculus was done by Dr. Finney, the patient dying two days afterward from anuria. As revealed by autopsy, the left ureteral catheter had happened to enter the normal branch of a bifid ureter which led to a lower normal kidney segment. The upper half of the kidney was pyonephrotic and contained a large calculus which was not revealed by the X-ray examination because the plate had happened to be placed too low. In Figure 22, a drawing by Mr. Broedel, of the autopsy findings, the

limits of the area covered by the X-ray plate are indicated by a slightly darker tone. The mistaken diagnosis was, therefore, dependent upon curious co-existent pathological and anomalous conditions, taken together with two unfortunate incidents. If the catheter had entered the other branch of the bifid ureter, purulent urine would have been obtained instead of normal urine and if the X-ray plate had been placed higher the large calculus would have been discovered. At that time pyelography had not been introduced.

The remaining twenty-one cases of double kidney were all nephrectomies, and in all but one (Albarran, 27) the operation was complete nephrectomy. In three of them (Lange, Chute, Linck) the second portion of the kidney was said to be "obliterated," "functionless" and hydronephrotic respectively, and Pilcher's case showed a double pyonephrosis, the lower pyonephrotic sac being the larger, and containing a stone. The removal of this double kidney, reported by Dr. Louis S. Pilcher was the last operation done by Dr. Paul M. Pilcher before the development of the pneumonia which caused his death. Nephrectomy, in these four cases, was undoubtedly the method of choice. Sixteen of the double kidneys, however, were half normal, and would have afforded an opportunity for partial nephrectomy with preservation of a normal portion. The cases were those of Brewer (28), Bruci (29), Dumitreanu (30), Dobrotworsky (31), Floderus (32), Heyman (33), Key (34), Kusnetzky (35), Marion (36), Martin (37), Rafin (38), Summers (39), Stolz (40), Tschudy (41), Wille (42), and Wulff (43). In this series of twenty-one nephrectomies the diagnosis of ureteral duplicity was made before operation in two instances only, while in nineteen the condition was accidentally discovered during the course of the operation, or later by an examination of the pathological specimen.

There remains the case of Albarran, the only one in the series in which the normal portion of the kidney was preserved. We find Albarran's brief mention of this case in the transactions of the ninth session of the *Association française d'urologie* (1905), in a discussion following a demonstration by Nicolich of a pathological specimen showing a supposed persistent muellerian duct in the male. In this discussion Albarran considered the specimen of Nicolich to be in reality one of supernumerary ureter opening into the prostatic urethra, and he then briefly described a similar case of his own in which he had removed the upper half of a double kidney for pyonephrosis. Apparently there was no stone. The operation was undertaken to cure a renal fistula resulting from a previous operation, and the abnormality was discovered accidentally and not by previous diagnostic methods. Albarran has made no official report of this case, but we quote his brief remarks in their entirety in the following literal translation:

> The patient was a young man of 26 years, who in Italy had had a nephrotomy for pyonephrosis, resulting in a fistula which discharged a small amount of urine and much pus. During the operation which I undertook to cure the fistula I found two kidneys, the one above the other, both firmly adherent, and demarcated, the one from the other, by a furrow. The upper kidney, the smaller, was almost destroyed by the pyonephrosis. After having cut the renal tissue at the level of the furrow which separated the two kidneys, I extirpated the superior kidney, which had an independent pedicle, together with its pelvis and a portion of the ureter, very dilated and thin. I do not know where the ureter ended below but it certainly did not go into the bladder which I have carefully examined with the cystoscope.

It is unfortunate that we have no illustrations and no adequate record of this case. As to the exact condition found at operation, the presence or absence of stone, the cause of the pyonephrosis, the point of junction of the two ureters and as to the convalescence and the ultimate result, we are not informed.

We find a brief mention of three operations upon presumably similar cases by Braasch (44) as follows: "Bisection of such a kidney was performed successfully in three instances by W. J. Mayo after the clinical diagnosis had been made." Other than this one sentence, no further report in this country has been found.

CONCLUSIONS

The case reported above is apparently unique in that it is the only such case to be found fully reported in the literature.

The condition of double kidney and ureter is not rare, and the upper half is most often the seat of disease; its surgical importance is therefore great.

The advent of ureteral catheterization, radiography and pyelography has made the diagnosis easy and we should expect the discovery of more cases in the future.

The radical cure by excision of the diseased half of the kidney with its pelvis and ureter is undoubtedly the method of choice.

REFERENCES

1. Burns, J. Edward. Thorium — a new agent for pyelography. Bull. Johns Hopkins Hosp., 1916, xxvii, 157.
2. Botez, G. Considerations sur la pathologie et la chirugie du rein du cheval. J. d'urol., 1912, 1, 193, 373, 503, 633.
3. Robinson, B. Prevalence of disease in one of the duplicate ureters. Am. Pract. and News, 1909, xliii, 23.
4. Girard, J. De l'ectopie simple congenitale du rein. Paris: Vigot Freres, 1911.
5. Naumann, H. Ueber die haeufigkeit der Bildungsanomalien der Nieren. Kiel: 1897.
6. Papin, M. Les anomalies des arteres du rein et leur importance chirugicale. Ass. franc. d'urol., Proc.-verb., 1909, xiii, 443.
7. Adrian and Lichtenberg. Die klinische Bedeutung der Missbildungen die Niere, des Nierenbeckens und Harnleiters. Ztschr. f. urol. Chir., 1913, i, 183.
8. Poirier, P. Sur quelques phenomenes consecutifs aus injections ureterales. Compt. rend. Soc. de biol., Paris, 1891, ix, 9, s., 3, 585.
9. Wagner, Paul. Angeborene Missbildungen der Nieren, Nierenbecken und Harnleiter. Handb. d. Urol., 1905, ii, 53.
10. Bostroem, E. Beitraege zur pathologischen Anatomie der Nieren, vol. i. Freiburg i. B. and Tuebingen: J. C. B. Mohr., 1884.
11. Weigert. Ueber einige Bilungsfehler der Ureteren. Arch. f. path. Anat., etc., Berl., 1877, lxx, 490.
12. Kerr, A. T. Complete double ureter in man. Anat. Rec., 1911, v, 55.
13. Pohlman, A. G. Abnormalities in the form of the kidney and ureter dependent on the development of the renal bud. Bull. Johns Hopkins Hosp., 1905, xvi, 51.
14. Felix, W. The development of the urogenital organs in man. Human Embryol. (Keibel and Mall) II, 157, Philadelphia and London, 1912.
15. Kelly and Burnam. Diseases of the kidneys, ureters, and bladder. New York: Appleton and Company, 1914.
16. Huntington, Geo. S. The genetic interpretation and surgical significance of some variations of the genito-urinary tract. Harvey Lectures. Philadelphia: J. B. Lippincott Company, 1906-1907, p. 222.
17. Josephson, C. D. Ausmuendung eines ueberzaehligen Ureters in die Vulva, durch Nierenresektion geheilt. Zentralbl. f. Gynaek., 1909, i, 836.
18. Stammler, A. Zur Kenntnis der aberrierenden, ueberzahligen Ureter. Ztschr. f. urol. Chir., 1914, ii, 241.
19. Lange. Nephrectomy for acute surgical kidney: double ureter. Ann. Surg., Phila., 1901, xxxiv, 581.
20. Chute, A. L. A suppurating supernumerary ureter opening into the prostatic urethra. Boston M. & S. J., 1907, clvii, 385.
21. Linck, A. Pyonephrose bei Verdoppelung der rechten Niere. Deutsche Ztschr. f. Chir., 1904, lxxv, 51.
22. Pilcher, L. S. Kidney with double pelvis and double ureter: nephrolithiasis: pyonephrosis; nephrectomy. Ann. Surg., Phila., 1917, lxv, 534.
23. Steiner. Doppelniere mit hydronephrotischen Degeneration der unteren Haelfte; geheilt durch Nierenresektion. Verhandl. d. deutsch. Geselsch. f. Chir., 1901, xxx, 15.
24. Franke. Abstr. by Adrian and Lichtenberg. Ztschr. f. urol. Chir., 1913, i, 183.
25. Scudder, C. L. Double ureter of the right kidney; one ureter ending blindly; acute symptoms; operation; death. Am. J. M. Sc., 1901, n. s., cxxii, 46.
26. Young, H. H. Ueber einen Fall von doppeltem Nierenbecken und Ureter bifidus; Katherisation des gesunden Teiles; Fehldiagnose; Tod nach der Operation. Monatsb. f. Urol., 1903, viii, 591.
27. Albarran. Compt. rend. de l'assoc. franc. d'urol., 1905, ix, 580.
28. Brewer, G. E. Some observations upon the surgery of the ureter. Ann. Surg., Phila., 1911, liii, 827.
29. Bruci. Rein a bassinet double et a uretere incompletement dedouble; pyelonephrite suppuree de la moitie superieure du rein et du bassinet correspondant. Ann. d. mal. d. org. genito-urin, 1911, xxix, 961.
30. Dumitreanu, V. Deutsch. med. Wchnschr., 1908, xxxiv, 1333.
31. Dobrotworsky, B. Ein Fall isolierter Tuberculose der einen haelfte einer anomalen doppelten Niere. Ztschr. f. Urol., 1913, vii, 93.
32. Floderus. Om betydelsen af medfoedda ureter-missbildningar ur kirurgish synpunkt. Nord. med. Ark., 1899, N; r 9.
33. Heymann, A. Ein seltener Fall von Nierentuberculose. Ztschr. f. Urol., 1912, vi, 473.
34. Key, E. Ein Fall von tuberculoeser Niere mit doppelten Ureteren. Ztschr. f. Urol., 1909, iii, 409.
35. Kusnetzky, D. P. Ueber einen Fall von Niere mit zwei Ureteren. Partielle Pyonephrose infolge von Verstopfung des einen der Ureteren durch einen Stein. Ztschr. f. Urol., 1909, iii, 927.
36. Marion. Pyonephrose partielle (dans un rein a deux ureteres). Bull. et mém. Soc. de chir., de Paris, 1908, xxxiv, 905.
37. Martin. Hydronephrosis from inadequate ureter; suppuration; double ureter. Univ. Durham Coll. Med. Gaz., 1905-1906, vi, 63.
38. Rafin. Hydronephrose partielle; bifidite de l'extremite superieure de l'uretere. Ann. d. mal. d. org. genito-urin., 1909, xxvii, 184.
39. Summers, J. E. Double ureter. Ann. Surg., Phila., 1901, xxxiii, 39.
40. Stolz. Ueber einen Fall von Nieren und Ureterananomalie. Abstr. by Adrian and Lichtenberg. Ztschr. f. urol. Chir., 1913, i, 183.
41. Tschudy, E. Ueber einen Fall von Doppelbildung der linken Niere mit Pyonephrose des einen Nierenbecken Harnleitersystems. Cor.-Bl. f. schweiz. Aerzte, 1902, xxxii, 400.

42. WILLE, H. En exstirperede nyre med dobbelt ureter og nyreboekken; det ene pyonefrotisk, det andet normalt. Forh. i Kristiana kirurg. foren., 1909, p. 14.
43. WULFF, P. Ueber einen Fall von incompleter Ureterverdoppelung. Monatsb. f. Urol., 1906, xi, 525.
44. BRAASCH, W. F. The clinical diagnosis of congenital anomaly in the kidney and ureter. Ann. Surg., Phila., 1912, lvi, 726.
45. DENONVILLIERS, C. Propositions et observations d'anatomie, de physiologie et de pathologie. Theses de l'ecole de medicine, Paris, 1837, x, 285.

SUPERNUMERARY AND SINGLE URETERS OPENING EXTRAVESICALLY[1]

E. S. JUDD, M.D., ROCHESTER, MINNESOTA

THE ureter arises as a process from the posterior wall of the lower end of the wolffian duct. Its distal end divides normally into two branches which grow into the blastoma of the kidney. Each branch then divides and subdivides and forms the straight and uriniferous tubules and calyces. Early in embryonic life the proximal end of the ureter opens into the lower end of the wolffian duct, but under normal conditions at about the sixth week the ureter and duct separate and open separately. If the ureter does not become detached from the duct and accompany it in its downward course, the ureteral opening may be found in any one of the organs developing from the urogenital sinus. If the wolffian duct and the ureter fail to shift before the urorectal septum forms in the cloaca, the ureter opens into the rectum. Apparently this condition is very rare; I have not been able to find it mentioned except in reports of the fœtus otherwise abnormally developed. If the ureter continues its association with the wolffian duct, it empties into one of the organs developed from the duct, such as the vas deferens, seminal vesicle, ejaculatory duct, or Gartner's duct.

Furniss has reported a case of supernumerary ureter with an extravesical opening. He abstracted an article by Hartmann, of Copenhagen, who has analyzed 37 cases collected from the literature, 14 of which were supernumerary. In these 37 cases, the extravesical openings were distributed — 6 in the urethra, 8 in the vagina, 21 in the vestibule of the vagina, and 2 in Gartner's duct. Hartmann's review shows that the abnormal opening, whether from a single or from a supernumerary ureter, most often occurs in some part of the vagina. In such cases in the embryo, the ureter maintains its connection with the muellerian or wolffian duct. However, it very seldom empties into the fallopian tube or uterus. Such abnormalities are reported to have been found in the fœtus in a few instances.

If the ureter does not become separated from the wolffian duct, the opening may occur in the urethra or in the vestibule of the vagina, and apparently this is the embryonic abnormality which occurs most frequently.

It is possible that this abnormality is much more common than we are led to believe from the cases reported in the literature, and may be explained by the fact that it is usually very difficult to make a diagnosis of the condition even though the clinical features are almost always suggestive. The 37 cases reported by Hartmann apparently included all the cases in the literature at that time (1913). In 14 of these, the opening was that of a supernumerary ureter; in the remaining 23 the ureter was single or the exact condition was not determined. Furniss also abstracted an article by Hartmann of Leipzig, who had collected 16 cases of positive supernumerary extravesical ureters, 12 cases of uncertain supernumerary extravesical ureters, and 7 cases of a single ureter opening extravesically.

Kelly and Burnam describe one case in which a single ureter opened into the urethra, five other observers reported cases of a single

[1] Presented before the Western Surgical Association, Omaha, December 15, 1917.

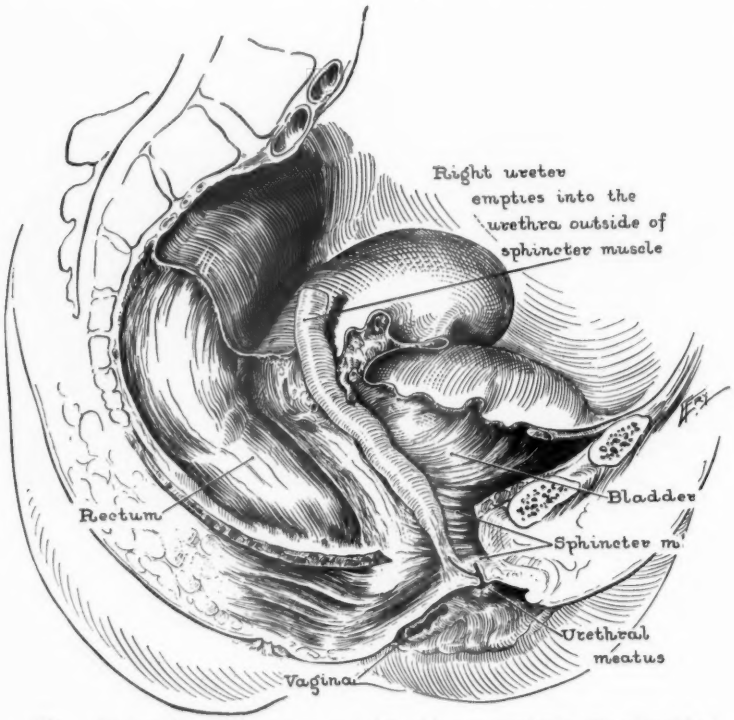

Fig. 1 (A163923). Single ureter on right side was markedly dilated and had a thickened wall. This ureter opened into the urethra posteriorly, one and one-half centimeters below the sphincter muscle.

ureter opening into the vagina and three reported cases of supernumerary ureters with openings in the vagina. Peacock reports a necropsy on a child nine months old, that had four ureters, one of which terminated in the vesicoprostatic urethra.

I wish to add to the cases in the literature, reports of two cases; one in which a single ureter opened into the urethra, and one in which the supernumerary ureter opened into the vagina.

A clinical history of constant incontinence of urine, associated with periods of normal urination, suggests the existence of a ureter with an opening outside the bladder-sphincter. Such a history was characteristic of both of our cases. In the patient having a supernumerary ureter, this history had been constant from birth up to 18 years of age, at which time she was operated on elsewhere and obtained complete relief. Her symptoms returned six years later during her first pregnancy, although the incontinence was not so regular or typical as it had been previously. For several days and sometimes for weeks there would be no leakage when she would have a period of incontinence. Following delivery her condition improved and during her second pregnancy the symptoms returned and persisted until she was operated on.

Our second case was that of a girl 22 years of age. The ureter opened into the urethra, and she had had incontinence as long as she could remember. There is one point of unusual interest in the history of this patient; apparently for long periods there would be no leakage at night and at times no soiling during the day. We were unable to explain this until at operation a greatly dilated and thickened ureter was found, which seemed to

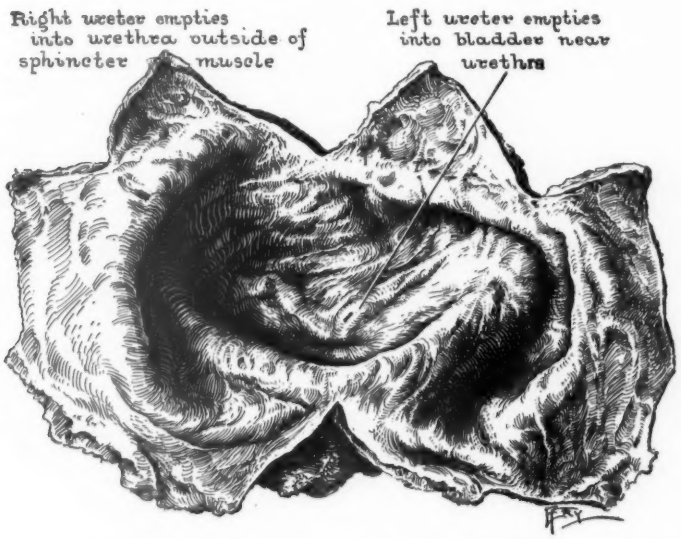

Fig. 2 (A163923). Probable appearance of a bladder having only one ureteral meatus near median line and just above urethral sphincter.

indicate that it had been obstructed at times and that there was considerable infection in its walls. Infection was naturally to be expected in this type of ureter, in spite of the fact that the urine collected before operation showed only a small amount of pus. Soon after operation a large amount of pus was found in the urine, but this gradually cleared up. Before operation the patient had three attacks of acute pain in the right side, probably due to an inflamed appendix, although it was possibly caused by the infection in the kidney and ureter.

In addition to these two cases, a number of cases of urinary incontinence have been treated, especially among young girls, in which we were not able to determine the etiology. In some the condition was probably due to a low-grade inflammation of the bladder, obscure nervous disorder, or to a relaxed bladder-sphincter, very uncommon among young unmarried women. It is also possible that in some instances the incontinence was due to a ureter with an extravesical outlet, although the opening could not be located at the time of the examination. In our examinations, in order to locate the abnormal opening, we have employed methods very similar to those described by Furniss.

The suggestion of a single ureter is substantiated by a cystoscopic examination which shows the absence of the other. In our case, the ureter was located very close to the bladder-sphincter, but it could be seen distinctly. Even if there is a supernumerary ureter, the cystoscopic examination may reveal a normal bladder with normal meatus and normally functioning kidneys, as in one of our cases. If an extravesical opening is suspected and cannot be located, we have found it helpful to place pledgets of cotton in the vagina and urethra and over the meatus of the urethra, injecting subcutaneously and intravenously some sort of dye which colors the urine as it is eliminated. If the extravesical opening does not discharge continuously it may be necessary to repeat the procedure several times.

Treatment consists of implanting the truant ureter into the bladder. This has been done in several ways, most often I think, by vaginal operation. In some instances a small sac has been found at the lower end of the ureter and has caused some difficulty in operating.

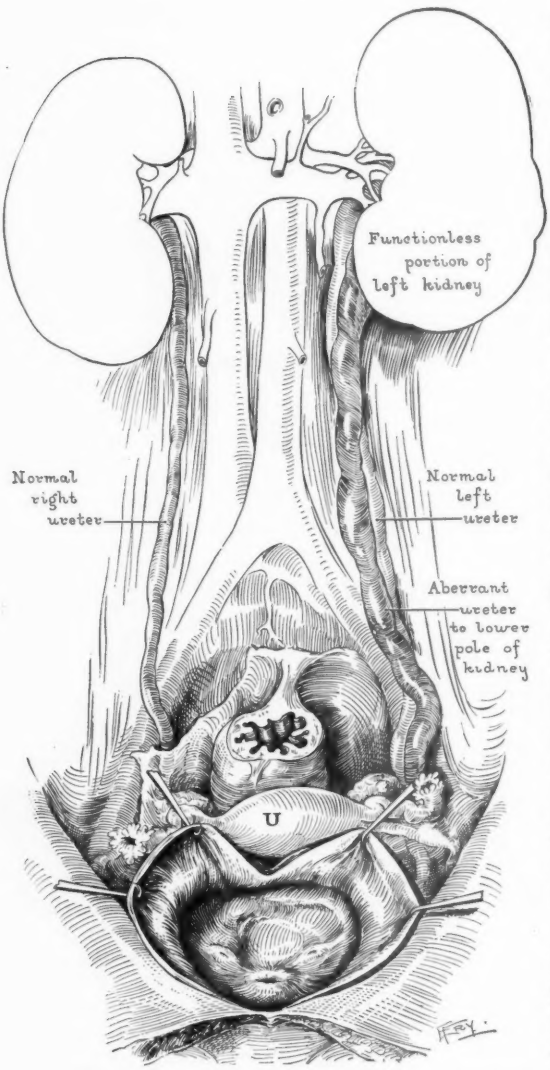

Fig. 3 (A177181). Normal bladder with two ureters and meatus on the left side. The aberrant ureter crosses the normal one at two distinct points. The supernumerary ureter probably drains the upper segment of the kidney.

In the case of the supernumerary ureter herein described, Dr. Maxon, of California, had previously performed a vaginal operation. The ureter had been freed in the vagina, an opening made in the bladder over a sound, and the ureter drawn into it. The operation had completely relieved the patient and undoubtedly she would have remained well if changes had not been produced by the pregnancies some years later. The stretching of the tissues had altered conditions so that at the time of our examination it was impossible to determine the area of implantation. We felt sure that this ureter had been closed continuously for long periods and that it would be very difficult to reimplant it on account of the scar; therefore the supernumerary was ligated with satisfactory results.

Under ordinary circumstances, however, it is my opinion that the procedure of choice is the abdominal extraperitoneal implantation of the abnormal ureter. This was done very satisfactorily in our second case in spite of the fact that there was considerable infection in the ureter. The technique of the abdominal operation is more accurate and the implantation may be made with a better chance of preserving the lumen of the ureter and therefore, the function of the kidney. We have sufficient evidence to show that ureters transplanted in this manner will continue to functionate and maintain a normal kidney-function over a number of years. We have recently examined two patients in whom the ureter had been transplanted four years previously and in both instances the adjoining kidney was practically normal. In our two cases under discussion the incontinence was relieved immediately and relief has been permanent.

Case A163923. M. L., a single woman, age 21, first consulted us June 27, 1916. The menstrual history was normal. She complained of diurnal enuresis which had troubled her all her life. She had had nocturnal enuresis when she was younger, but not recently. She complained of constipation and stated that when her bowels moved freely or following physic, she had very little or no trouble. The dribbling of urine was not constant, but strain or excitement caused it to escape. Previous to one year before examination she had had three attacks of sharp, colic-like pain in the right side of the abdomen, each of them lasting from one to two days. The attacks of pain were followed by soreness, and the physician who saw her in the attacks told her they were due to appendicitis. In repeated examinations of the urine considerable pus was found, and cystoscopic examination showed some inflammation in areas at the left base. The ureteral meatus on

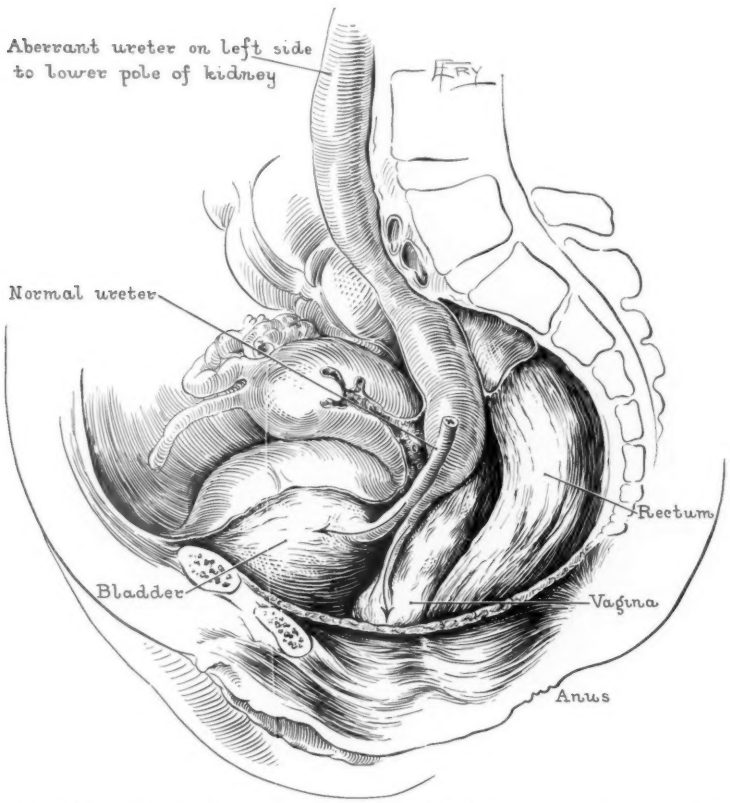

Fig. 4 (A177181). The lower ends of the normal and supernumerary ureters. The supernumerary ureter was normal in its diameter for one and one-half inches where it became markedly dilated as far as could be determined.

the right side could not be found; the left meatus situated just inside the internal sphincter muscle on the left side appeared to be entirely normal, and clear urine was seen coming from it. The bladder-sphincter was apparently relaxed and it was thought that this might account for the incontinence (Figs. 1 and 2.)

Operation. The sphincter was tightened by folding it upon itself and by taking a few stitches, but this did not relieve the symptoms. Ten months later the patient returned for an examination, at which time her history was typical of extravesical ureter. She had incontinence and dribbling of urine and in addition voided normally from three to five times daily. It was necessary for her to wear a pad constantly.

Cystoscopic examination at this time showed a left ureteral meatus situated just inside the bladder-sphincter. On withdrawing the cystoscope an apparently normal meatus was found in the right wall of the urethra 1.5 centimeters outside the bladder-sphincter. The right ureter was normal in length.

The right ureter was exposed through a right rectus extraperitoneal incision. The ureter was greatly dilated and thickened. It was surprising to find such marked infection in the wall of the ureter, which, of course, was positive indication that the kidney was infected. However, we decided to implant the ureter, and if necessary to perform a nephrectomy later.

A few days after the operation the patient had considerable pain in the region of the right kidney and there was pus in the urine. Two ureteral catheters were readily passed into the pelvis of the kidney and continuous pelvic lavage was instituted. From this time on the pain decreased. The wound healed promptly although there was slight urinary drainage from it for a few days. The incontinence ceased after the operation and she has had no fur-

ther trouble of that nature, although at times there has been evidence of pylonephritis, such as pain in the side and an occasional slight chill. Repeated cystoscopic examinations have been made and the kidney pelvis has been irrigated. At the present time, eighteen months after operation, the patient is practically free from symptoms, and will probably not require nephrectomy. The functional capacity of the right kidney is only about half that of the one on the left side.

CASE A177181. J. T. R., female, age 48; married 17 years. The patient had two children, 16 and 13 years of age. The menopause occurred three years previously. This woman came for examination because of urinary drainage from the vagina; from birth she had had partial incontinence. When 18 years of age, she was operated on for this trouble by Dr. Maxon. In a communication from Dr. Maxon he states that a congenital truant ureter was found at operation. The right ureter passed just under the anterior vaginal membrane, but had no connection with the bladder and came out very near, but not in common with the lateral meatus of the urethra at the time of the operation. The patient was dribbling about half the urine. Dr. Maxon dissected the ureter from the external opening for about 2.5 inches up the anterior vaginal wall. He then cut away about 2 inches of the ureter, passed a sound into the bladder and made an opening in it about where the ureter would normally enter. After placing one stitch in the lower end of the ureter, fully one-half inch of it was pulled into the opening made in the bladder and sutured there. The vaginal wall was closed. In a few days the redundant portion of the ureter came away and an uneventful recovery followed (Figs. 3 and 4).

This operation was performed twenty-two years previous to our examination and the patient was entirely relieved until her first pregnancy when, about the fourth or fifth month of gestation, the incontinence returned. It was not so constant, however, except when she was on her feet. During the second pregnancy she had a greater degree of incontinence. When she was first examined at the clinic the trouble varied; it was worse at times, but there was some incontinence most of the time.

On several examinations of the urine small amounts of pus were found. The cystoscopic examination was negative. Both ureteral meatus appeared normal, the individual phenolsulphonephthalein output was normal, and there was no evidence of the supernumerary ureter in the bladder. There was unquestionably some escape of urine into the vagina although it was difficult to determine where it was coming from.

Operation. A small incision into the scar of the former operation led into a little pocket which seemed to contain urine, but it was impossible to pass a probe through the pocket into the bladder; it could only be passed about one-half inch. The sac was stitched over, and apparently the condition was relieved. However, the relief was only temporary and in a few weeks there was a greater amount of drainage than previously. Several months later we succeeded in passing a probe into the pouch for several inches, but it did not pass into the bladder. We again dissected out the fistulous tract, and found that it led to a supernumerary ureter which was strictured about 2 inches from the opening. There was some dilatation above this point. There was a great deal of scar tissue due to the former operations. The ureter had undoubtedly been closed previously for long periods and it was probable that the adjoining kidney tissue was destroyed. It seemed safe to ligate the ureter, and this was done with complete and permanent cure of the incontinence.

After the operation the patient had some increase in temperature which lasted for several days There was little or no pain in the region of the kidney and no other evidence of trouble from the ligation of the ureter.

REFERENCES

1. HARTMANN, J. P. Zur Kasuistik und operativen Behandlung ueberzaehliger aberranter Ureteren. Ztschr. f. Urol., 1913, vii, 429–446.
2. HARTMANN, J. P. Ueber die extravesikale Ausmuendung der Harnleiter bei Frauen. Ztschr. f. gynaek. Urol., 1913, iv, 69–88.
3. FURNISS, H. D. Supernumerary ureter opening intravesically. Surg., Gynec. & Obst., 1914, xviii, 584–586.
4. KELLY, H. A. Diseases of the kidneys, ureters and bladder, with special reference to the diseases in women. New York: Appleton, 1914.
5. PEACOCK, A. H. Multiple ureters with hydronephrosis. J. Am. M. Ass., 1916, lxvi, 1088–1089.

MIXED TUMORS OF THE SALIVARY GLANDS

A Study Based on the Experimental Production of Neoplasm in the Submaxillary Gland of the Dog[1]

By ALEXANDER FRASER, M.D., New York
Assistant Professor of Pathology, University and Bellevue Hospital Medical College, and Assistant Pathologist, St. Vincent's Hospital

THE theories of origin of the mixed tumors of the salivary glands may be classified as follows:

1. *The endothelial.* This theory, which is the most widely accepted of all, postulates that the tumor-cells are derived from the endothelium of so-called lymph-spaces or lymph-vessels, and that the myxomatous tissue and cartilage are derived by metaplasia, either from the connective tissue of the stroma (Virchow) or from the tumor-cells themselves. This view was fathered by Volkmann (1) and has since received the support of nearly all writers except those of the French school. More recently it has been revived and advocated by von Hansemann, who claims he has traced the development of an enchondroma to a lymphangioma, and by Martini (2) who thinks he can see the continuation of the tubular structures with proliferated endothelium of the lymph-vessels.

2. *The embryonic* (*de l'embryone juxta-salivaire* of Forgue and Massabuau). According to these authors the mixed tumors of the salivary glands should be classed with those of the testicle, i.e., they are embryomata. There is little evidence for this theory and it has few supporters.

3. *The branchial theory.* The presence of cartilage and bone in these tumors had already suggested a possible connection with the cartilage of Meckel (Virchow and Renaut), and even with the cartilage of Reichert (Hinsberg). Cuneo and Veau (4) developed the theory of their origin from vestiges of the branchial clefts. This theory is viewed favorably by F. C. Wood (5) in his excellent paper on the subject, published in 1904, and has recently been resurrected by Chevassu (6) under the name *d'enclavome.* It would seem, however, that this view has thus far attained little more than the status of an hypothesis unsupported by definite facts either pathological or embryological. Masson and Peyron (7) point out that the genetic line between the branchial inclusion described by Veau and the tumors to which they are supposed to have given birth has never been observed, and call attention to essential morphological differences between structural elements of the mixed tumors and those of the true branchial tumors which are of comparatively rare occurrence. On the embryological side they bring forth many considerations which go to show that this theory not only has no embryological basis but that there are many facts which tend to exclude it.

4. *The theory of origin from adult epithelium of the salivary glands.* This is the theory which has been most widely advocated by French writers. It was first presented by Perrochaud in (8) 1885, and was supported by Voyer and de Larabrie (9), Collet (10), and de Ponsot (11), Berger, Morestin, Malherbe and Pailler. Up to the present time, facts in support of this view have not been established and there are several objections to it, chief among which are its failure to explain the presence of cartilage in the tumors, and the fact that the tumors are usually encapsulated and show no connection with the glandular structures.

5. *The theory of origin from embryonic glandular germs.* Pittance, in 1895, was the first to suggest that the mixed tumors might arise from portions of the embryonic salivary gland which, having lost their connection with the ducts, remain dormant as undifferentiated tissue. Such "rests" could, at the same time, develop pavement and glandular epithelium. Wilms (12) modified this theory by assuming that the "rest" concerned should be a tissue not of one order but of two, a so-called "ecto-mesodermic" rest. A similar

[1] From the Department of Pathology, University and Bellevue Hospital Medical College. Director: Dr. Douglas Symmers.

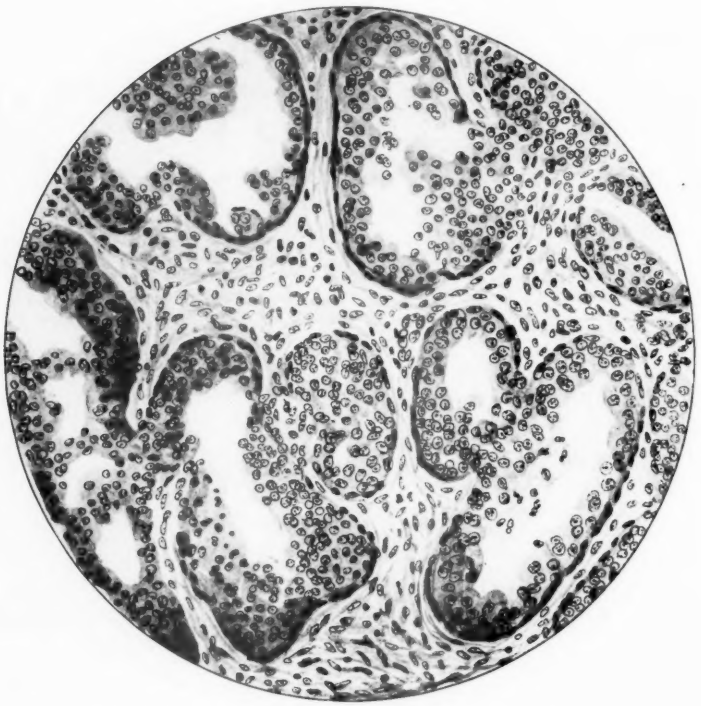

Fig. 1. Epithelial outgrowths from cyst wall in Dog 2. Note the prominence of the outer basal cells of the alveoli.

theory is adopted by Massabuau (13) in a paper published in 1907. In 1912 Wilson and Willis (14), in reporting a study of 56 mixed tumors of the salivary glands, conclude that "there is considerable evidence to support the theory that these tumors are mesotheliomata of embryonic origin." They, however, do not give this evidence, nor do they refer to any embryological data in support of the assumption that there is such a thing as mesothelium in the facial region.

It may be said that the epithelial origin of the parenchymal cells is advocated by the majority of recent writers. Epithelial characteristics of both the pavement and glandular type have been demonstrated beyond question. The only unsatisfactory aspect of this view lies in the difficulty of explaining the polymorphism of these tumors, or more specifically, the presence of cartilage, and sometimes of bone developing in what is usually regarded as the "stroma." The more favored way out of the difficulty is the assumption of a mesodermic rest associated with the epithelial elements of origin—an assumption which is wholly gratuitous, being unsupported, thus far, by any facts. The other less favored theory and one which runs counter to the established facts of normal embryology, is that the connective-tissue elements of the tumors are derived by metaplasia from the epithelial cells. This view is ably supported in the work above cited, by Masson and Peyron, in which by a detailed cytological study with the use of various techniques, they claim to have demonstrated the successive steps of this metaplasia. They refer in detail to several analogous processes in comparative and human embryology, but especially to the develop-

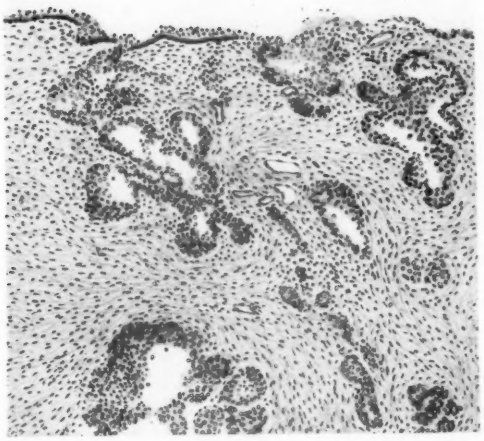

Fig. 2. Outgrowths from cyst wall in Dog 1. Cyst wall at top.

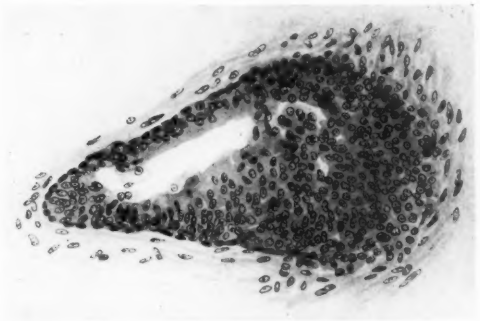

Fig. 3. One of the alveoli in Dog 2, showing outgrowth of epithelium through the basement membrane.

ment of the enamel organ in which they see an exactly similar transformation to that taking place in the mixed tumors. The primary cells of the tumor, according to Masson and Peyron, are derived probably

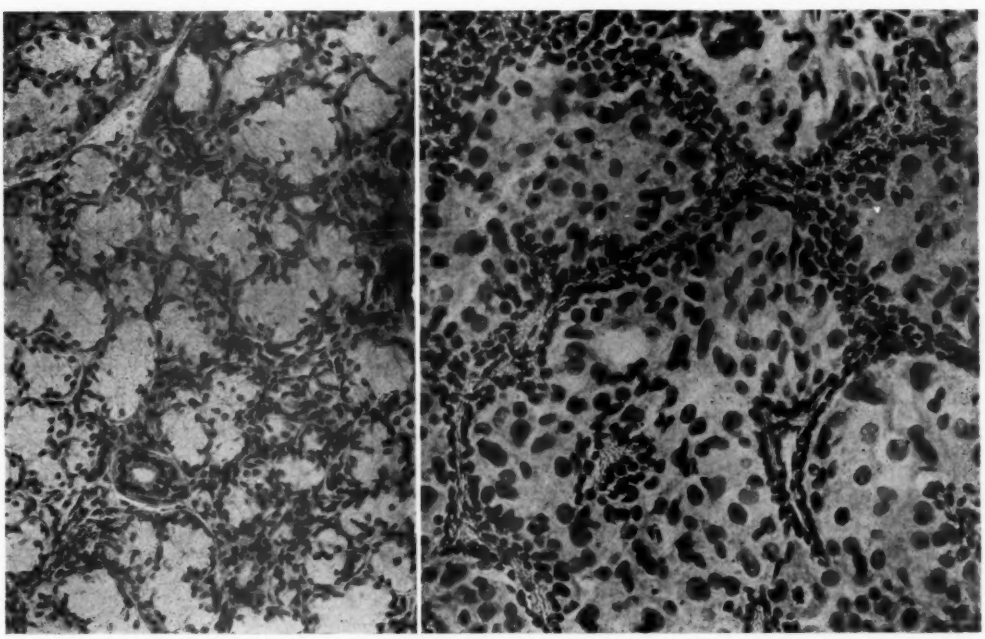

Fig. 4 (at left). Portion of a lobule showing proliferation of the basket cells of the alveoli. (Dog 3.)

Fig. 5. Section from human mixed tumor of parotid (Case 1, Group 2), showing alveoli with two types of cells; the inner large cells and the outer cuboid with deeply staining nuclei. Note the proliferation of the latter outward into the stroma and compare with that shown Fig. 4.

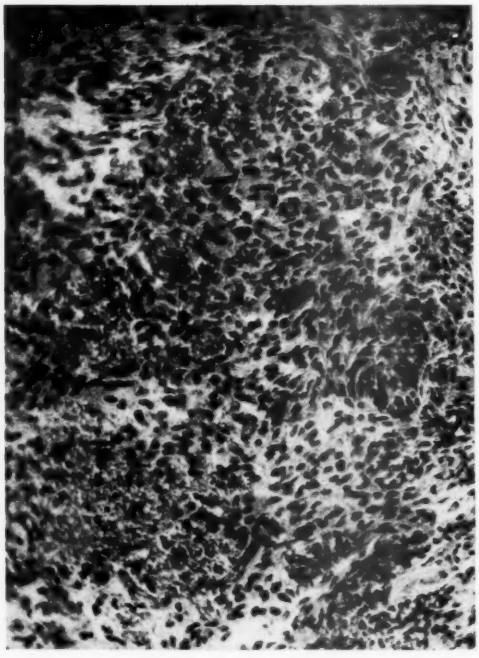

Fig. 6. Another section from a lobule of Dog 3, showing the basket cells which have broken through the basement membrane infiltrating the stroma and simulating spindle cell sarcoma.

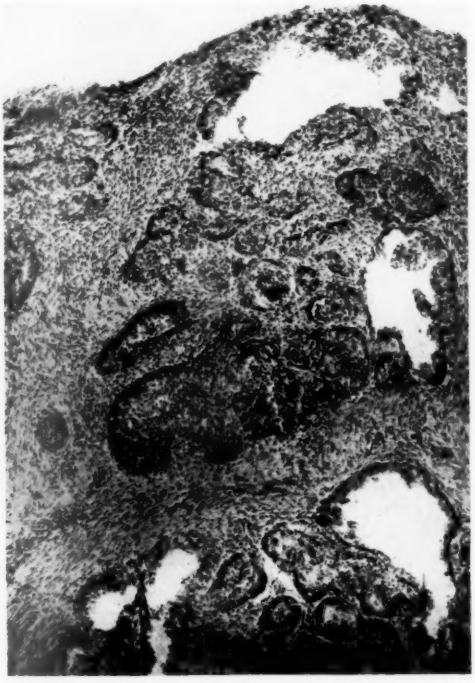

Fig. 7. Section from Dog 4. Upper border represents a cyst wall. The empty spaces within the section are places where the epithelium had been destroyed by leucocytes and has fallen out.

in some cases from embryonic, and in other cases from adult, salivary epithelium. But these authors defer the presentation of this phase of the subject for a later publication.

In view of the fact that up to the present the evidence in support of any of these theories has been purely morphological and that the interpretation of the structures seen is often based on superficial similarities, I have made an experimental study of the morphological reaction of the salivary glands to injury, with the object of observing the regenerative changes on the part of the salivary epithelium and whether the character of such changes would serve to establish any definite clue as to the origin of the mixed tumors. In connection with this work, there has been carried out a comparative study of 21 neoplasms of the salivary glands (18 of the parotid and 3 of the submaxillary).

EXPERIMENTAL

The experiments reported here were performed on the submaxillary gland of the dog. The most successful results were obtained in young animals, two and three months old. Various methods of injury were tried, such as removal of a portion of the gland, ligature of the duct at its junction with the gland, and under the mylohyoid muscle, and injection of various substances (Sudan III, Scharlach R., anilin and calcium salts) through the duct, and externally into the body of the gland. I shall report only the cases in which the duct was ligated at its junction with the gland, as the conditions in the other cases were not favorable to a fair trial.

In the cases here reported the submaxillary gland was exposed and the main duct (as was thought at the time of operation) was

Fig. 8. Represents duct regeneration on the site of a destroyed lobule (Dog 1).

tied close to the gland. It would seem, however, from the results of the operation that all of the excretory outlets from the gland could not have been included in the ligature as many of the lobules and their ducts were not materially affected by the procedure. Nine dogs were operated on in this way. In 24 hours the glands had swollen to the size of a hen's egg or larger, and were very hard and tense. In the course of a week the swelling subsided considerably. In 4 of the dogs the mass was completely liquefied at the end of 2 weeks, and soon ruptured into the wound in the neck, oozing a bloody mucopurulent fluid. In these four cases the glandular tissue was found at necropsy to be completely necrotic. In the remaining cases only a portion of the mass became liquefied, the remaining adjacent part appearing as a very hard and solid mass varying in size from 1.5x1x2 cm. to 2x2x3 cm. These dogs took nourishment badly and rapidly became extremely emaciated. They were killed and necropsies were made at the end of 4 weeks. The changes of interest in this study were practically the same in all 5 cases so that a description of each individual case is unnecessary. At necropsy the fluctuating portions of the masses proved to be epithelial lined cysts with hard solid masses closely attached to and apparently continuous with their walls. The cut surface of the solid masses was flecked with grayish white spots which stood out prominently in contrast with the rest of the tissue. These spots were of various sizes and their edges presented serrations and sometimes finger-like projections, simulating the freshly cut surface of the down growths of a skin epithelioma. Between these projections were in some places areas of gelatinoid appearance, while in others the tissue was hard and fibrous. These white spots were not evenly distributed over the surface of the solid mass. They were most densely collected near the cysts. In the regions farthest from the cyst walls, and frequently in compressed masses at its outer surface, were other dull gray areas of quite different appearance, which represented preserved portions of the gland.

Fig. 9. Similar area from Dog 2. Note prominence of outer cuboid layer of cells in duct in upper right corner.

HISTOLOGY

The cyst walls are lined by epithelium which varies in character in different situations. In some places there are two layers; an outer cuboidal and an inner tall cylindrical. Sometimes this cuboidal layer approaches the cylindrical type, i.e., the nuclei are oval and stand with their long axis at right angles to the basement membrane. In other situations the cuboidal cells are flattened and look like endothelial cells. In still other portions of the same cyst wall the inner cylindrical layer is absent and the cuboidal cells extremely flattened, thus giving the cyst the appearance of a lymphatic vessel. There are also remarkable features in the proliferative tendencies of these cells. In places the cuboidal cells have become spindle or oat shaped and are seen growing down through and for some distance below the basement membrane in broad sheets, simulating a type of small spindle-cell sarcoma. More frequently, however, the epithelium of the cyst wall extends outward in stout, budding finger-like processes which terminate in groups of large, tubular or solid alveoli which are round or oval in shape, and sometimes branching into tortuous intricate labyrinths of cells. These structures are lined externally by an even row of cuboid cells with deeply staining nuclei. Some of them are tubular and have an inner lining of large spheroidal cells with a large amount of acidophilic cytoplasm and large, round or oval, moderately chromatic nuclei. These cells evidently correspond to and represent a modified form of the cylindric cells of the cyst, and the solid masses are evidently formed by their proliferation inward (see Figs. 1 and 2). This whole picture which has as its most striking peculiarity the prominence of the even row of deeply staining cuboid cells at the periphery of the alveoli is remarkably similar to that of the alveolar

structures found in one of the mixed tumors of the parotid to be described later. In most of these structures, there is a distinct structureless basement membrane immediately external to the layer of cuboid cells, but in some of the secondary buds and in some isolated alveoli, this membrane is broken by the outgrowth of the outer row of cells which spread outward for some distance into the surrounding tissue (Fig. 3). In several places prolongations from these outgrowths can be traced directly into encapsulated collections of epithelial masses which probably represent the sites of lobules or groups of lobules of the gland. These latter are surrounded by thick fibrous capsules which send extensions between and around the contained epithelial masses, of which some are solid while others are tubular in structure, and in shape round, oval, or elongated, branching or more properly "budding." Between them or in their neighborhood can be seen in some places the faintly staining framework of the glandular acini, the meshes of which are filled with small basophilic granules (serous granules) and frequently accompanied by numerous mononuclear phagocytes and occasional giant cells.

The cells of these epithelial growths vary in character. Frequently the differentiation of the peripheral and the central cells stands out prominently by the deep staining of the former, two or three tiers of which are flattened and elongated, and sometimes grow out in thin winding strands following the course of the framework of the glandular acini. In many of the masses the cells are chiefly of the squamous type, and the whole structure simulates a cut-off interpapillary "down growth" in early epithelioma of the skin. In others the cells are smaller and several perfectly round lumina appear in the mass, giving it the so-called cylindromatous appearance so frequently seen in tumors of the salivary glands. In still others, especially in the smallest masses, there is no distinct basement membrane, the cells are chiefly of the basal type, and radiate from the center to the surrounding tissue simulating another structure frequently found in salivary tumors. Besides these solid structures, there are

Fig. 10. Interlobular ducts (Dog 3) showing proliferation of outer germinal cells. Note mitoses.

others which are distinctly tubular and frequently lined by two distinct layers of epithelium, an outer cuboidal and an inner cylindrical; another feature which is characteristic of the structures found in the mixed tumors.

The gelatinoid areas observed macroscopically correspond histologically to destroyed lobules containing large quantities of seromucoid secretion.

In several lobules which have been affected but not destroyed, an interesting picture is observed. The inner layer of cells lining the acini has disappeared and the lumina are filled with mucin. The interesting feature is the marked change in the outer layer of so-called "basket cells." These cells which

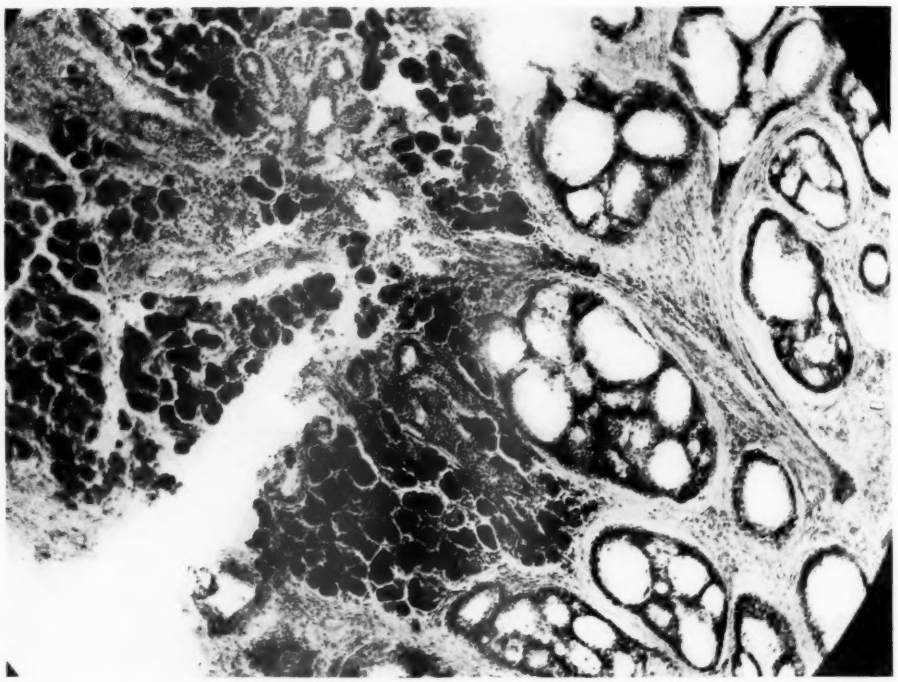

Fig. 11. Section from human parotid tumor (Case 1, Group 1), showing cylindromatous masses occupying site of interlobular ducts. Note normal gland with dark serous granules in the acinar cells to left and several intralobular ducts running into the tumor.

are a continuation of the outer cuboidal layer of the ducts and which probably represent the germinal epithelium of the gland, normally are barely noticeable as very much flattened nuclei just inside the basement membrane of the acini. In these lobules in which the cylindric cells of the acini have disappeared and the lumina are filled with a clear substance which does not stain with hæmatoxylin and eosin, the framework of the gland lined with these proliferating basket cells stands out very prominently (Fig. 4). The cells are markedly increased in number and the nuclei which have acquired a spheroidal or more frequently a spindle shape radiate from the stroma with their long axes frequently at right angles to the basement membrane. This framework with its surfaces more or less thickly coated with these proliferating deeply staining nuclei is remarkably similar to the stroma of the alveolar structures in Case I, Group 2, of the mixed tumors studied (see Fig. 5). In some of the lobules these basket cells have proliferated so abundantly that they fill the lumina of the acini, thus transforming them into solid masses of small deeply staining spindle cells, and in a few places they have grown outward through the basement membranes in diffuse sheets simulating closely small spindle-cell sarcoma (Fig. 6).

In one of the cases in which aniline was injected into the duct and the latter ligated under the mylohyoid muscle, a small portion of the gland which had escaped destruction by the aniline showed two or three nodular outgrowths which histologically were of an adenomatous nature. The acini assumed the form of tubules lined with large epithelial cells with a large amount of dense basophilic

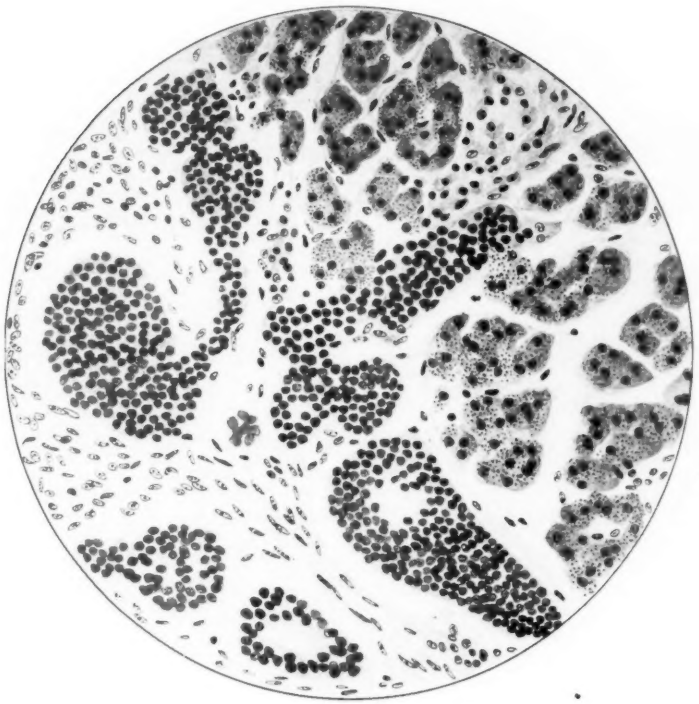

Fig. 12. Section from parotid tumor (Case 2, Group 1) showing neoplasm occupying the site of interlobular ducts and extending into normal lobule on site of an interlobular tubule. Note two points of junction with the acini, the cells of which contain darkly stained serous granules.

cytoplasm. Some of the tubules were large and showed invaginations or papillary ingrowths of their walls. Here too the basket cells showed, though in a lesser degree, the same characteristics as in the lobules above described.

The areas of preserved glandular tissue show practically normal gland. The interesting feature is that they are separated from the affected areas by thick bands of fibrous tissue.

It is not claimed that the structures above described fulfill all the requirements necessary for classification as true neoplasms. Morphologically they are. A few of those near the cyst wall are entirely new formations infiltrating the surrounding connective tissue (Figs. 1, 2, 3, and 7). The most of them, however, occur apparently on the site of the destroyed lobules of the gland, but they are new in the sense that they are not what was there normally. They are not like the normal acini and ducts. They are evidently formations produced by proliferating ducts, but they are atypical enough in morphology and number to be regarded as neoplasmic (Figs. 8 and 9). It is realized, however, that in order to justify their classification as neoplasmic, the indefinite persistence of their growth would have to be proved, and this proof is not forthcoming from the results of our experiments with their present limitations.

But the purpose of the experiments was not to produce neoplasm but to observe the behavior of the salivary epithelium in the process of reaction to injury and to note whether the changes occurring bore any

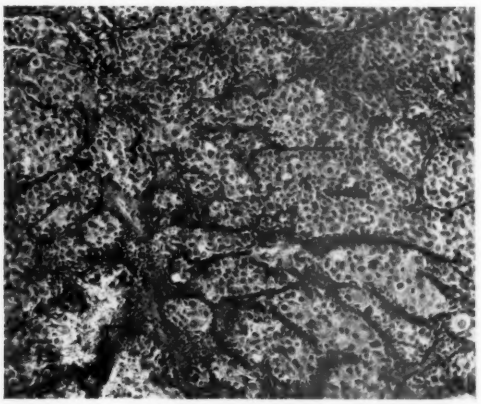

Fig. 13. Carcinomatous alveoli from Case 1, Group 2. Note prominence and proliferation into stroma of the outer cuboid cells.

resemblance to those represented in the elementary structures observed in the parenchyma of the mixed tumors. The essential features of the changes observed may be summed as follows:

1. The remarkable regenerative power of the ducts.

2. The coming into prominence of two layers of epithelium in the lining of the ducts and the retention of the differentiation in the new formations (Fig. 10).

3. The tendency of the inner, cylindrical, layer to grow inward in solid masses of large epithelial cells (Fig. 1), and of the outer cuboidal, to grow outward through the basement membrane in smaller polygonal or oat-shaped forms simulating cells of the basal layer of the skin (Fig. 6).

4. The development of apparently entirely new formations in the shape of epithelial outgrowths from the cyst walls, both as pavement and as glandular structures.

5. The marked tendency to encapsulation of the affected portions of the gland as a consequence of which they are completely separated by a thick band of fibrous tissue from the preserved or uninjured portions.

In regard to (2) that is, the two layers of duct epithelium, it may be called to mind that this is the normal structure of some portions of the ducts though it is seldom seen in ordinary sections and not mentioned in many textbooks on histology. Krause [1] in describing the sublingual gland of man (which description is to include the parotid and submaxillary ducts) says: "the large ducts . . . . are lined by a double layer of cylindrical epithelium. Further inward we have a layer of moderately high cylindrical cells, covered by a bright red (Biondi stain) cuticular band, underneath which we see a single layer of cuboidal cells." Particular attention is called to this fact because of its obscurity and hence of its being overlooked in the consideration of tumors of the salivary glands, and because a double row of cells forms one of the most striking characteristics of the parenchymal structures in all the mixed tumors studied in this work.

[1] Histology, vol. ii, p. 185. New York: Rebman Co.

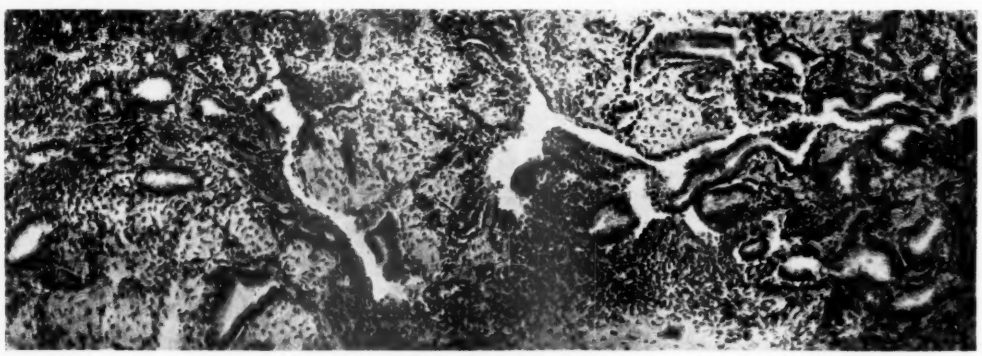

Fig. 14. Section from typical mixed tumor showing duct formations lined by cylindric cells with a distinct cuticular border.

Fig. 15. Drawing of similar structures (Case 1, Group 2). Note even row of outer cuboid cells and inner cylindric layer with cuticular border.

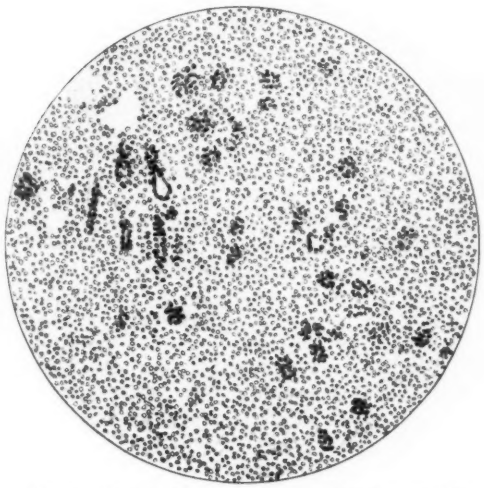

Fig. 16. Section from mixed tumor showing proliferation outward of the outer layer of cells. Early myxomatous change gives them a lighter appearance than that of the duct cells.

Salivary tumors. One of the tumors of the parotid studied shows in a few places intimately intermixed glandular and pavement epithelial structures which fact, together with the history of the case, confirms its parotid origin. For the most part, however, the histology of the tumor is indistinguishable from a typical squamous cell epithelioma. One of the submaxillary tumors shows very similar histological features. Two of the parotid tumors are carcinomata with structural elements closely imitating the glandular acini. In none of these is there any history of metastasis to distant organs, but there is extensive infiltration of the surrounding tissues and immediately adjacent lymph-nodes. One of the parotid tumors is a large spindle and giant cell sarcoma apparently originating from the stroma of the gland. History of the case subsequent to removal of the tumor was not obtainable.

As these tumors do not show the classic features of the so-called mixed tumors they will not be considered further.

Mixed tumors. Of these there are in the collection studied 14 from the parotid and 2 from the submaxillary. The tumors show at first sight considerable difference and might easily be made to fall into classes, such for instance, as those given by Wood and by Wilson and Willis, but, as will be shown, these differences are superficial and of degree rather than of essential structure, and classifications based on them can be of no real help to the pathologist. In the parenchymal structures, for example, tubular or solid types may predominate, or the cells may spread out in sheets; or the individual cells may vary in size and character, being sometimes large and squamous-like, sometimes small and of the rodent ulcer or perhaps spindle-cell sarcoma type, and at other times cuboid or cylindrical; or again, the so-called stromal, or what are believed to be, according to the results of this study, secondary parenchymal changes may vary. By these we mean myxomatous and allied changes, the development of cartilage and sometimes of bone. If, however, all parts of each tumor are carefully searched, it will be found that they frequently show, to some extent at least, the same variations in structure and secondary changes as appear to characterize and distinguish the different tumors. For example, microphotographs

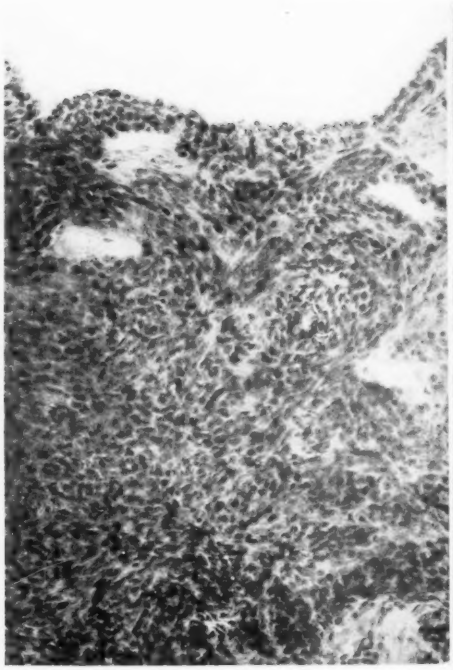

Fig. 17 (at left). Section from mixed tumor showing sarcomatous outgrowth of the outer layer of cells of a cystic duct.

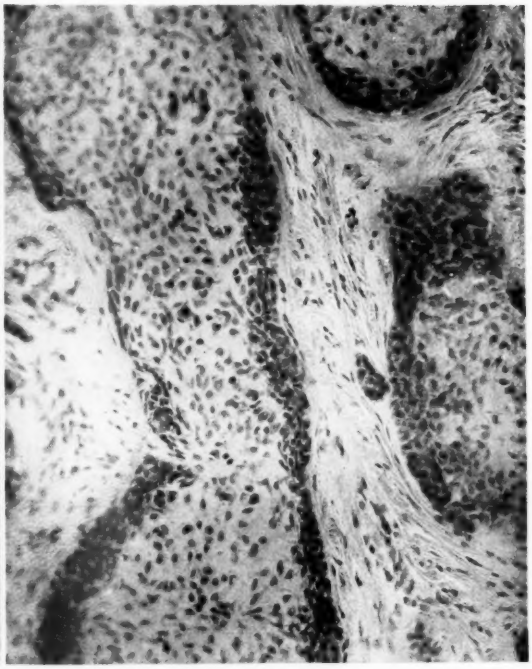

Fig. 18. Section from mixed tumor showing myxomatous change taking place in the central portions of epithelial cords. Compare development of enamel organ.

from different sections from Case 1, Group 2, can be used to illustrate any of the features of the other cases with the exception of the presence of bone which is found in only one of our tumors. Or again, at the first study and by the use of the hæmatoxylin and eosin stain alone, the presence of cartilage could be confirmed in only two of the tumors, but when further study was made by the use of special stains, e.g., cresyl violet, widely scattered groups of cartilage cells were found in 11, and the precartilaginous process as indicated by the presence of the cartilage matrix was evident in all.

However attractive the above indicated variations may be, and however distinct the classes which they tend to create may seem, I am convinced from a two years' uninterrupted study of the mixed tumors in this collection that in all of them the parenchymal structures can be reduced to the same morphological unit of origin, and an attempt will be made to show that this unit is the salivary duct.

For the sake of clearness in the description of the tumors, I shall deal with the *parenchyma* which will include only what are evidently primary structures and the *secondary changes* separately, and without making a classification shall consider the tumors in two groups:

Group 1. In this group there are four tumors.

Parenchyma. The structure is uniform, and consists of large and small masses of epithelium. The shape of the larger masses is round, oval, or elongated and branching. The cells are uniformly small, round and basophilic, suggesting in places the appearance of lymphocytes. The larger alveoli appear as solid masses which have within them numerous round or oval lumina which

frequently have no distinct lining of cells; they are simply holes in the centers of cell accumulations. These holes are frequently filled with a "bulging" like substance which gives a positive mucin stain (Fig. 11). This is the type of structure which Borst and Wood give in their drawings as cylindroma. The smaller masses are round or oval in shape and may be solid or tubular in structure. The tubular forms are usually lined by two rows of cuboid cells, but occasionally by an outer cuboid and an inner cylindrical layer.

In many places in these cases lobules of the gland are well preserved but between them interlobular ducts cannot be found. In their places we see tumor masses and a most interesting result of the study of this group is the fact that in 3 of the cases direct and indubitable connection of these tumor masses with the gland can be demonstrated. Furthermore, it can be seen that these points of connection correspond to the junctions of the interlobular and intralobular ducts. It is clear from the sections that these connections are not attained by a process of infiltration, but that the tumor masses are developed by a proliferation of the epithelium of the ducts. In Figure 12 from Case 2 is shown one of these connections with one of its short branches directly continuous with an acinus of the gland. Where the acinus commences is well brought out by the basophilic serous granules in the cytoplasm of the cells. These are not present in the tumor cells. Figure 11, Case 1, shows another such connection. Several intralobular ducts are seen uniting at the periphery of a lobule and becoming continuous with one of the large cylindromatous masses of the tumor. Occasionally near these tumor masses, sometimes in the center of a group of them is seen a large, widely distended duct with a thinned out wall, giving the appearance of dilatation from obstruction. The acini do not play any part in the neoplasmic process. The only change they show is atrophy from compression by the expanding tumor masses and probably from obstruction of their ducts.

Though this type of parenchymal structure is the only one observed in these four tumors,

Fig. 10. A typical picture of the salivary mixed tumors, showing duct structures with the characteristic double row of cells, myxomatous change and developing cartilage cells.

this fact cannot justly form the basis for a classification for the same type of structure is found in some of the tumors in Group 2 which also show the usual polymorphism of the mixed tumors.

Secondary changes. In this group, the secondary changes are few and unimportant. There are no cartilage-cells present, and there is no bone formation. There are, however, limited areas of myxomatous and allied changes among which is the deposition of a substance which by its staining affinities appears to be the same substance as forms the cartilage matrix in the tumors of Group 2. In these myxomatous areas, the tumor masses become thinned out and the cells flattened and elongated. When this change becomes extreme the neoplasm assumes the appearance of long, winding, thin strands of elongated flat cells growing out through the myxomatous matrix in a manner to suggest endothelial formations.

Group 2. In this group are 11 tumors and

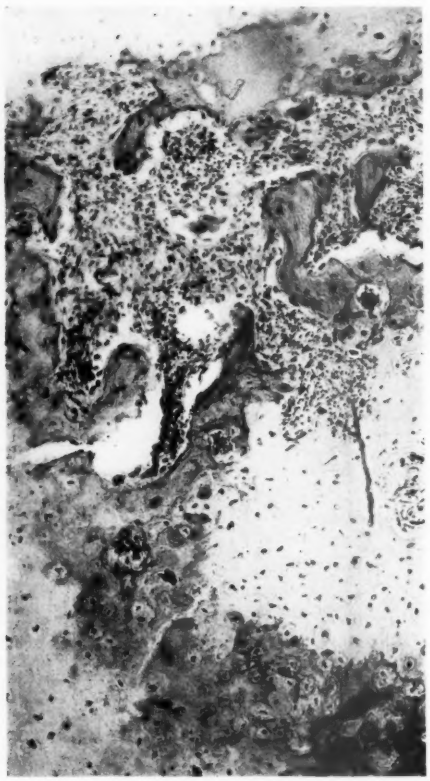

Fig. 20. From a submaxillary tumor showing cartilage some of which is calcified, and osteoid formation.

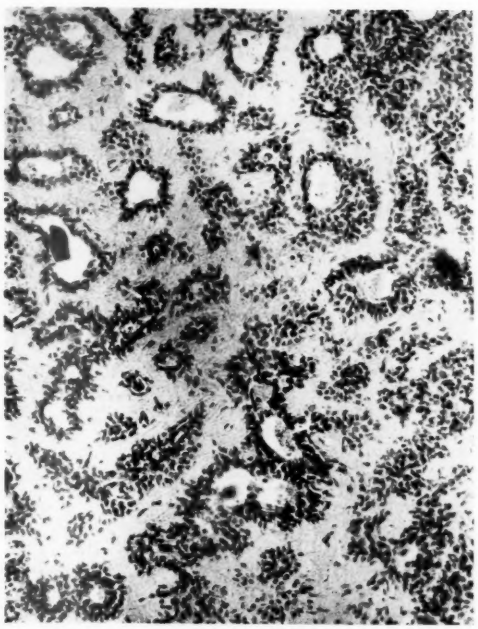

Fig. 21. From parotid mixed tumor showing so called peritheliomatous formations.

they are considered together because of their fully developed polymorphism and secondary changes. As stated above, two of them are not only representative of the structures of their own group but of the cylindromatous formations characteristics of Group 1 as well, and sections from these chiefly will be used in illustrating the histological features of the whole group.

Parenchyma. In some of the members of this group, we may find large microscopic fields occupied by sheets of small polygonal, oval, or spindle-shaped cells, interspersed here and there with spots of myxomatous tissue, looking very like myxosarcoma, but it would be an error to consider such a field as representative of the primary structure of the tumor. On the contrary, we must try to find where these cells originate, and if all parts of the tumor are carefully studied this can be determined in each case. In all the cases without exception what is evidently the primary structural unit is an epithelial formation, either solid or tubular, which has a definite basement membrane and shows two types of cells, an outer cuboidal layer and inner cells which vary in character according to whether the formation is tubular or solid.

If the formation is solid, the inner mass of cells may vary some in size and staining qualities, but most frequently they approach the squamous type, are arranged somewhat concentrically, and occasionally show true "pearl" formation.

The cells of the solid alveoli, however, though large, are not always of the malpighian type. In one of the tumors of this group (Case 1), are areas containing alveoli of exceptionally large cells which, both in

their character and arrangement, suggest a carcinoma of acinar origin rather than an epithelioma (Fig. 13). In these alveoli, on account of the contrast effected by the large amount of clear cytoplasm of these inner cells on the one hand and the small evenly set hyperchromatic nuclei of the outer cuboid cells on the other, these latter stand out more prominently than in any other parts of the tumor. And as these cuboid cells, proliferating in a manner to be described later, form a peculiar-looking hyperchromatic border for the stroma of the alveoli a picture (Fig. 5) is presented which is decidedly similar to that of the changes found in the acini of some of the gland lobules in the experimental cases previously described. Furthermore, by the use of serial sections of the particular areas under consideration it has been demonstrated that these solid alveoli of large cells are directly continuous with and constitute the terminations of the adjacent distinctly tubular structures, and that they are formed by proliferation and modification of the inner cylindric epithelium. Even in single sections transitional structures and points of continuity can frequently be seen. These particular alveoli, then, as the above facts, would indicate, are probably an atypically accomplished attempt on the part of the duct-like structures to form glandular acini.

If the structure is tubular, the inner cells may consist of one layer of cuboidal and one or more layers of cylindrical cells. Not infrequently can be seen a tube which is lined by an outer layer of evenly placed cuboid cells and an inner layer of tall cylindric cells covered by a broad inner cuticular border which stains a deep red with eosin; in short, a typical representation of portions of the normal salivary ducts (Figs. 14 and 15). Sometimes the cells of the outer layer are flattened, representing possibly certain portions of the normal duct in some instances and in others the effect of pressure by proliferating adjacent cells. At other times, and quite frequently so, they assume a short cylindric type due evidently to a release of pressure brought about by softening of the basement membrane and external tissues as a result of myxomatous degeneration. The cells of the inner layer too undergo various changes but most frequently an extreme flattening as an effect of pressure by a so-called "colloid" substance which accumulates in the lumen of the tube, and which stains pink with eosin and varying shades of red with metachromatic stains such as cresyl violet. The successive steps of transition from the tall cylindric type to that of flat endothelial-like cells are frequently demonstrable in a single microscopic field. As a result of a combination of the above-mentioned changes, one can frequently see tubular structures lined by perfectly flat endothelial-like cells from which radiate outward a row of moderately tall cylindric cells, structures which constitute one of the most constant and most striking features of the histology of the mixed tumors, and probably the feature which has played the most prominent part in suggesting the endothelial origin of these neoplasms (Fig. 21).

Sometimes the solid masses undergo a change which gives them the appearance of tubular structures, viz: by necrosis of the central mass of cells. The central necrotic material becomes homogeneous and stains pink with eosin, thus giving the appearance of "colloid" within a tube. Many have thought this to be the mode of formation of all the tubular structures found in these tumors, but that this is not so can be positively determined by the use of special stains, and by the fact that the tubules are lined by an inner layer of cylindrical epithelium, which frequently shows the deep red cuticular border characteristic of the inner cells of the salivary ducts.

When this central necrosis takes place, the peripheral epithelium is compressed and there is left the appearance of a tubular structure lined by rather flattened epithelium arranged concentrically in several layers. This constitutes the so-called lymph- or hæmangio-endotheliomatous structure of the advocates of the endothelial theory.

As the solid masses are developed from a primarily duct-like formation by a growth inward of the inner layer of cells, so other characteristic appearances of the parenchyma

are developed therefrom by a growth outward of the outer cuboidal cells. This outward growth may take place simultaneously with the formation of the solid structure or alone. An early stage of this proliferation of the outer cuboid cells is shown in Figures 5 and 13. These cells grow through the basement membrane and spread out in sheets until they meet with similar outgrowths from the neighboring tubular structures. As they grow outward, they become less deeply staining and may undergo various changes in size and shape, so that the microscopic field as a whole presents the appearance of tubular or solid structures without basement membranes embedded in a diffuse mass of cells which may show all grades of difference from the cells of the original structures (Fig. 16). In Figure 17 is shown the cells of the outer layer of the wall of a dilated duct-formation proliferating outward and assuming the appearance of the cells of a basal cell epithelioma. As they spread further out, they present the picture of a small spindle-cell sarcoma. This change in the character of these cells has led to the belief that they are of separate origin from the more definite structures which they surround; that is, that they are developed either from the stroma or from the second germ in a bigerminal embryonic rest. Or again, the picture sometimes suggests the differentiation of mesothelium from mesenchyma in the development of the convoluted tubules of the kidney. It is quite possible and in some tumors quite probable that new solid and tubular formations of embryonic type and without basement membranes are developed from these cells somewhat in this latter way, but a careful comparative study of many sections of such tumors leaves no doubt that the cells themselves are epithelial and that they are derived primarily from previously formed duct-like structures in the manner above described.

It is in these cells that myxomatous and allied changes to be noted later usually take place, and these are most marked farthest away from their ducts of origin. And when, as before stated, the inner cell layer of a duct becomes flattened out by secretion (colloid) and only a few tiers of the proliferated outer cells have escaped the myxomatous change, we have presented to us one of the most common and most characteristic pictures found in the mixed tumors of the salivary glands, viz., an apparently endothelial lined tube with several rows of cells radiating outward from the wall. This is the so-called "lymph- or hæmangioperithelioma" of the supporters of the endothelial theory.

In addition to the formations already described as characteristic of the salivary mechanism, there is present in one of the tumors of this group, and that in one of the most representative ones, Case 2, a type of structure which points strongly to a parotid glandular origin. In this tumor there are numerous groups of tubules which on cross section present a very similar picture to that of the normal intralobular ducts of the parotid gland. These tubules are lined by tall cylindrical cells presenting a dark inner and light outer zone with the nucleus situated at the junction of the two. The light outer zone shows fine striations radiating outward at right angles to the basement membrane. These are the rod cells of Heidenhain which are the characteristic cells of the parotid intralobular ducts. Some of these structures are solid and others show a clearing of the central cells representing the early stage of lumen formation. A few structures of this type are found here and there in some of the other cases, and might be regarded as merely accidental appearances, but in this tumor they are so numerous and so arranged in groups that there can be no doubt that they are definite primary structures.

In none of the members of this group have direct connections between the neoplasm and glandular lobules been found as in Group 1. Remnants of normal gland are present here and there in some of the cases, but definite relations with neoplasmic structures are not in evidence. In four of the tumors, however, are large cysts beneath the capsule of the neoplasm which from their double lining of cuboid and cylindric epithelium are evidently dilated ducts, and the epithelial outgrowths from these strongly suggest that they may be the structures from which the

neoplasmic process originated. This suggestion is heavily reinforced when these cystic developments are compared with the exactly similar processes which have previously been described in connection with some of the experimental cases.

In these latter, as before stated, the outgrowths from the cyst walls are evidently entirely new formations and not merely regenerations of old structures, and if what is morphologically neoplasm is experimentally developed in this way it is justifiable to infer in the case of the tumors under consideration, that the presence of similar cystic formations indicates for them a similar manner of origin.

As in the experimental cases so in these tumors, the cells of the cyst wall are frequently compressed and flattened out so as to resemble a single layer of endothelium, and consequently the structure can easily be and frequently has been mistaken for a lymph-vessel. And this undoubtedly accounts for the claim by numerous writers that they have demonstrated the development of the mixed tumors from lymph-vessels in the tumor capsule. The true nature of the cyst, however, can be determined by the finding in some parts of its wall or in that of other cysts near by, the two characteristic layers of epithelium; an outer cuboid and inner cylindric. Martini and other advocates of the endothelial theory have always noticed these distinctly epithelial-lined structures associated with the so-called endothelial tubes, and they interpret their lining cells as embryonic forms of endothelium but they can hardly claim that embryonic endothelium is ever cylindrical with sometimes a distinct cuticular border and above all that it should so constantly take the form of the peculiar double row above described. This is the structure of the salivary duct and no other.

Secondary changes. I have already noted the marked changes which take place in the parenchymal cells, changes which amount to a true metaplasia. I shall now describe some further changes which are prominent in the members of this group, a group of changes which play an essential part in making up the histological complex which distinguishes the salivary mixed tumors as a class.

1. *Cylindroma.* Not infrequently we see a group of ducts filled with "colloid" and surrounded by a more or less broad rim of hyaline substance. This is the picture which Adami and others call "cylindroma," and it is quite common in the tumors of Group 1 as well as in those of Group 2. The peripheral change is brought about in probably several different ways as is indicated by the different staining qualities of the hyaline material in different places. For example, in some places it stains red with picrofuchsin while in other places it stains brown like colloid; in some places it stains red with cresyl violet and in other places green. In some instances the appearance is due to fibrosis and hyalinization of the surrounding stroma, in which case it stains red with picrofuchsin. In other instances it may arise through a colloid type of degeneration of proliferated epithelial cells at the periphery of the ducts, while at other times the hyaline rim appears to be a structureless substance deposited between the outer layer of epithelium, and the adjacent connective tissue; in short, it occupies the site of and looks like a very much broadened basement membrane. This peripheral change occurs not only around duct-like or tubular structures as above described, but also around the solid epithelial masses or columns. As the hyaline substance increases in amount, it encroaches on and replaces the epithelium of the mass or tubule from without inward until finally nothing is left but thin rings or strands of one or two rows of epithelial cells which give the appearance of being somewhat irregularly "stuck in" this highly refractive and structureless substance. Throughout the course of this change the double row of cells which I have before emphasized as the most constant characteristic feature of the primary structure of all these tumors, tenaciously persists and is apparent though somewhat changed in both the "rings" and "strands." In the former, the inner layer is frequently flattened from compression by the internal mass of colloid and the outer one appears as spindle-

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shaped nuclei arranged perpendicularly to it and radiating outward. As before stated, this picture represents a stage in the so-called peritheliomatous formations which have formed a basis for the endothelial theory. As above stated this type of cylindroma phenomenon may be produced by different changes, but in the instances in which the process advances to the extent just described, it is evidently of the same or at least of a closely allied nature with those to be described later under the head of myxomatous and cartilaginoid changes.

2. *Myxomatous change.* This change, so common in the mixed tumors is usually spoken of as taking place in the stroma or connective tissue, an error which I think is due to the fact that the change has been studied after its completion and not in its early stages. When more or less large areas of myxomatous change are present and especially as they are most frequently situated between tubular or solid masses of epithelium, they do undoubtedly suggest at first sight that they correspond to the site of what one would naturally suppose to be the stroma of the tumor. But if we study other areas with similar arrangement of the primary parenchymal structures which have not yet undergone to any extent myxomatous change, it becomes evident at once that the intervening spots which correspond to these myxomatous areas (in the former place) are not occupied by connective-tissue elements, but by dense sheets of epithelial cells which have grown outward from the periphery of the tubular structures. It is in these sheets of peripheral epithelial outgrowths which have been previously described, that myxomatous change is most frequently found. But not uncommonly it occurs in the central portion of the solid epithelial masses, spreading outward toward the periphery. In one of the tumors of this group this is the usual site of occurrence (see Fig. 18), and is so to some extent in several others. In this case the picture reminds one very strikingly of the changes in the medial layer of epithelium in the developing enamel organ. Without entering into cytological details the main steps of this myxomatous change may be epitomized as follows: (1) The cytoplasm of the cell becomes replaced with a substance which consists partly of a homogeneous, non-stainable, and probably fluid substance, and partly of very fine filaments which stain faintly ambophilic with hæmatoxylin and eosin, and varying shades of red with cresyl violet. (2) This substance becomes extracellular and appears in the same forms (homogeneous and filamentous). (3) The cells as a result of (1) and (2) undergo various changes in morphology, the cytoplasm is vacuolated or the cell membrane may appear distended and bulging, the cells become more or less widely separated by the pressure of the extracellular substance, the cell membrane is drawn out at various points into long strings which seem to be continuous with groups of the above noted filaments and with similar processes from neighboring cells, while the nuclei become small, crenated and distorted in shape. Stained with hæmatoxylin and eosin the earliest stages of the change present the familiar appearance of intra- and extracellular œdema of the epiderm, and this appearance when occurring in connection with tubular structures constitutes one of the chief features on which is based the diagnosis of nearly all so-called endotheliomata.

3. *Cartilage.* Though at least a few cartilage-like cells are found in all the members of this group, it is present in large amounts in only two; viz., the submaxillary tumors. With ordinary stains, such as hæmatoxylin and eosin, when the cartilage cells are few or in the early stages of formation, their presence is easily overlooked or not at all detectable. But with cresyl violet which stains the capsule deep red and the cell areolæ and matrix from different shades of red to reddish violet, they are easily picked out from the other tissues, and this stain is of great value in helping to determine just how and from what particular cells the cartilage develops. In regard to this development, it may be stated at the outset that there is no evidence whatever in any of these tumors that the cartilage develops from perichondrium either in the capsule or in the stroma of the tumor. On the contrary it is clearly evident in all

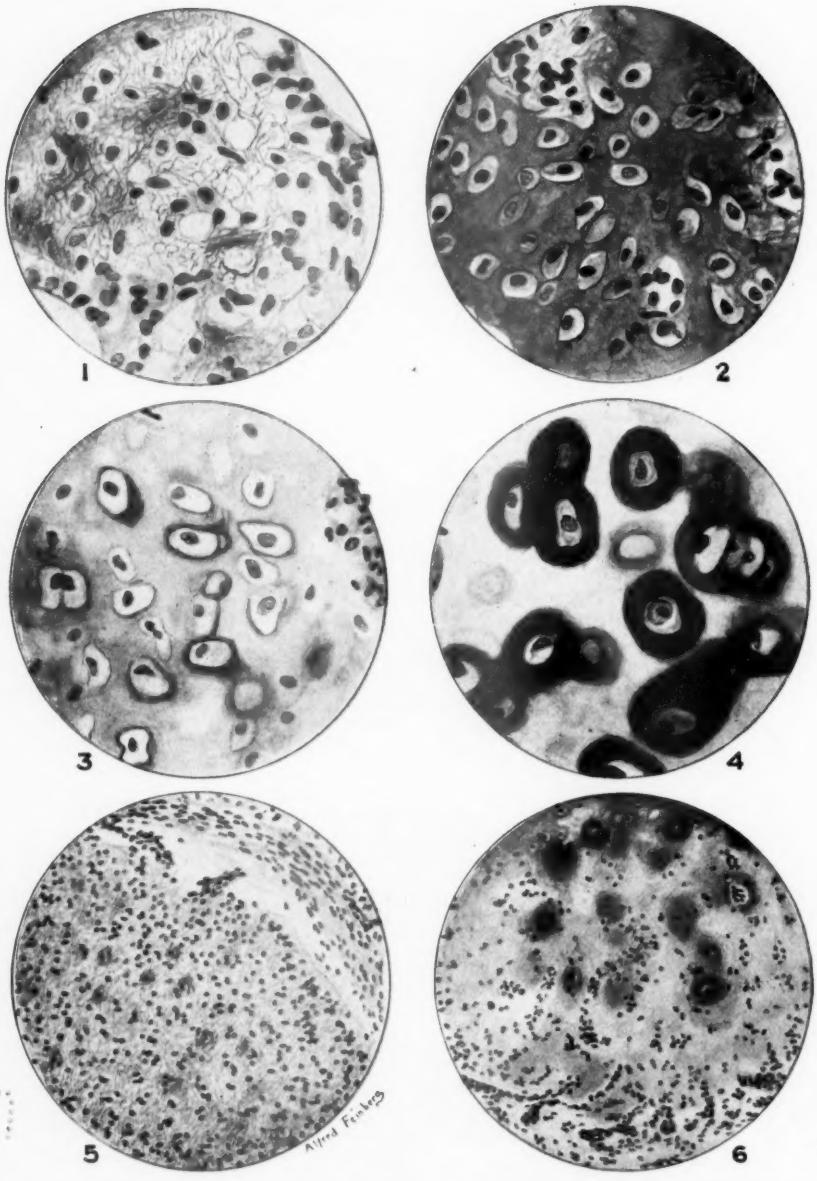


Fig. 1. Early stage of direct cartilaginous metaplasia of epithelial cells. Note the intracellular deposit of red metachromatic filaments. (Cresyl violet; high power.)

Fig. 2. Later stage of same, showing the metachromatic substance extracellular and condensed. (High power.)

Fig. 3. Third stage. Condensation of cartilage cell capsule and clearing of matrix.

Fig. 4. Final stage. (High power.)

Fig. 5. Early stage of cartilage formation in myxomatous epithelial cords. (Low power.)

Fig. 6. Later stage of same. (Low power.)

Mixed tumors of the salivary glands. (*Alexander Fraser.*)

that the process of cartilaginous formation originates and develops exactly in the same situations and in connection with the same elements as does the myxomatous change; viz., in the epithelium of the tumor parenchyma. When the cresyl violet stain is used, the first fact that engages the attention is the remarkable diffuseness of the process, it being found in some stage of its progress throughout practically all parts of the tumor. This fact alone seems enough to contradict the theory of origin from an embryonic rest of chondroblasts, inasmuch as on this theory we would expect to see growth by extension from one center, whereas, as a matter of fact, we see the change in all stages of its development arising from innumerable widely separated primary foci. The steps of the process in the formation of cartilage do not appear to be exactly the same in all the tumors or even in all parts of the same tumor, though in all probability the differences noticed are superficial rather than essential. Two such apparently different forms of the change are observed.

1. *Direct metaplasia.* This is the form observed (almost exclusively) in the submaxillary tumors, in one of which there is a large amount of cartilage and a considerable amount of osteoid tissue. The change takes place in the sheets of epithelial cells which have proliferated outward from the peripheral cuboid cells of the primary tubular or solid structures. Stained with hæmatoxylin and eosin, the first indication of the change is a vacuolization of the cytoplasm as is seen in intracellular œdema. Later, to this appearance is added separation of the cells or the picture of extracellular œdema. The appearance is exactly like that seen in early myxomatous change, but the process is not so extensive. Stained with cresyl violet, the first thing noticed is a reddening of the epithelium. This is due to accumulation in the cell body of a red staining substance which surrounds and obscures the nucleus. Later, this substance becomes extracellular and separates the cells, a process exactly similar to the myxomatous change, but in this case the red staining substance is homogeneous or composed of filaments which are closely packed together, whereas, in the myxomatous change it is always filamentous with the filaments widely separated. At this stage when this red matrix is still intra- as well as extracellular, viewed with a low power lens, the cells are only faintly visible, and the difference in appearance of the affected area from that of the surrounding epithelium is very marked. We can hardly get away from the suggestion that we are looking at tissue which is entirely different and distinctly marked off from the epithelial masses between which it lies. But if we view the picture with a high power, or better, oil immersion lens, we can see that this red homogeneous mass contains many cells which are still of the same character as and form a continuous sheet with the surrounding epithelial cells, the only difference being that they are covered over and obscured by this reddish substance. And, furthermore, we can at the same time positively determine that besides these there are no other cells in this matrix (see Plate, Fig. 1).

The next step in the process consists of an increase in the density of the extracellular and a disappearance of the intracellular substance so that the cells again become distinctly visible. They now appear as nuclei surrounded by a small or moderate amount of cytoplasm which in turn is surrounded by a broad clear rim or halo (see Plate, Fig. 2). The succeeding step is represented by an intensification of the density and staining of that portion of the extracellular substance immediately adjacent to the cell membrane, which now appears surrounded by a deep red rim; that is, the capsule of the cartilage cell (see Plate, Fig. 3). The final step consists in the differentiation of the cell areolæ and general matrix (see Plate, Fig. 4).

This metaplasia is not confined to the outwardly proliferated cells in which it commences, but gradually advances and involves the primary tubular or solid structures, though these are by far more resistant to the change. These are frequently changed *en masse* so that when the metaplasia is completed, they are represented by rings or solid alveoli of cartilage with much the same arrangement and inter-relations as they

possessed in their former epithelial state of existence. There is no evidence of nuclear division in the fully formed cartilage cells. They represent apparently an end-product. In the epithelium from which they are developed, however, mitoses are seen and frequently amitotic division of the nucleus resulting in the formation of two or three nuclei in the cells which are retained after their transformation into cartilage cells.

Specific stains show the presence of a few collagen fibers and a few to a moderate number of elastic fibers in the cartilaginous areas. They are most numerous about the periphery, and can be traced as extensions of the corresponding fibers of neighboring foci of stroma.[1]

2. *Indirect metaplasia.* In this form the cartilage formation develops apparently as a terminal step in the myxomatous change. It is exhibited extensively in the tumor (parotid) of this group which contains the second largest amount of cartilage. In this tumor, cartilage is not present in large compact masses. The whole tumor, which measures 10x9x6 cm., is largely made up of small nodules which macroscopically look like cartilage, but have not its consistency—they are soft. Histologically these nodules are lobules of epithelial alveoli which have undergone myxomatous change with the formation of a varying number of cartilage cells. The only apparent difference between the cartilaginous and the myxomatous changes seems to be that in the latter the metachromatic substance thrown out by the cells exists in the form of fine filaments which are accompanied and widely separated by a clear non-stainable fluid substance, whereas, in the former it is homogeneous or in filaments closely packed together. Probably the physical effect of the non-stainable fluid may account for the filamentous form of the metachromatic substance, for as the fluidity disappears the latter becomes more homogeneous. In fact, it is something like this that happens when cartilage cells are formed as a sequence of the myxomatous process. It can be observed that around a cell here and there the metachromatic threads are increased in number and lie closer and closer together until finally they form a homogeneous mass (see Plate, Figs. 5 and 6). In one stage of this metamorphosis the cells appear to be buried in a mass of radiating filaments that resembles one end of a sheaf of wheat. Later this mass becomes homogeneous, and the further steps in the process of metaplasia are the same as those already described in the direct form.

4. *Bone formation.* Bone or rather osteoid tissue is present in only one of the tumors, and this is apparently the only instance in which the stroma plays any part in the neoplasmic growth. In numerous places in the centers of groups of cartilage lobules, evidently on the site of what was originally the main stroma and vascular channels of the tumor there is a more or less successful attempt at formation of medullary canals. At the periphery of these canals in places can be seen rows of poorly formed osteoblasts with here and there an osteoclast externally to which is deposited a layer of osteoid tissue (see Fig. 20).

[1] Masson and Peyron claim to have demonstrated the deposition of collagen by the epithelial cells. I have not investigated this question thoroughly.

SUMMARY AND DISCUSSION

1. The mixed tumors arise from the ducts of adult glands. No claim is made that true neoplasm has been experimentally produced but the experimental results justify the conclusion that the primary structures of the mixed tumors may easily arise from the ducts of the adult gland. Facts established by the morphological study of 14 mixed tumors, such as, the connections of tumor and gland in Cases 1, 2 and 3, Group 1, as well as the cystic formations and their outgrowths in Cases of Group 2 practically prove the point.

Undoubtedly many of the histological phenomena in these tumors look odd and at first sight puzzling, and as is our custom when thus puzzled we are inclined to seek refuge in the embryonic realm. I have frequently shown sections of these tumors to experienced embryologists, but none of them seemed to recognize in them any structure with which he was familiar.

2. The endothelial theory has no foundation in fact. All the so-called endothelial structures are easily explained as natural

modifications of primary duct formations. The most common one, viz., the peritheliomatous formation is a figment without histological basis for it is now generally agreed among histologists that the perivascular lymph-space from the endothelium of which it is supposed to arise, is not a lymph-space lined with endothelium, but merely a tissue space to facilitate the expansion and contraction of the vessel.

3. Injury, such as localized or partial obstruction of ducts probably plays a prominent part in the origin of these tumors. Facts are accumulating daily in support of injury as a prominent factor in tumor production. Witness the Mayo records of the relation of gastric ulcer and cancer, the recent experimental production of a metastasizing tumor by the application of tar by Yamigawa and Ichikawa (15), the bladder tumors in aniline workers and numerous other like instances. The most common precursor of cancer of the breast, chronic cystic mastitis or diffuse fibroadenomatosis, is a condition very similar to the one produced in the dog's submaxillary gland.[1]

4. The cartilage is developed from the epithelium of the parenchyma of the tumor. This claim will undoubtedly meet with strong opposition but I am compelled to let the facts stand as above reported.

[1] I have already reproduced this condition with morphologically cancerous transformation in a series of experiments on the mammary glands of animals, the results of which will be reported in a forthcoming publication.

I wish to thank Dr. Douglas Symmers and Dr. Charles Norris for their kind co-operation in this work. I also acknowledge my indebtedness to Dr. Charles Goodman and Mr. P. V. Prewitt for skillful aid in the surgical work.

REEERENCES

1. VOLKMANN. Deutsche Ztschr. f. Chir., 1895, xli, 1.
2. MARTINI. Arch. f. path. Anat., etc., Berl., 1907, clxxxix, 337-414.
3. FORGUE and MASSABUAU. Province méd., 1908, Feb. 15 (quoted from Masson and Peyron).
4. CUNEO and VEAU. Cong. internat. de méd., Paris 1900, sect. de chir. gén., p. 128.
5. WOOD, F. C. Ann. Surg., Phila., 1904, xxxiv, 57-207.
6. CHEVASSU. Rev. de chir., 1910.
7. MASSON and PEYRON. Bull. de l' ass. franc. p. l, étude du cancer. Paris, 1914, vii, 219.
8. PERROCHAUD. Reserches sue les tumeurs mixtes des glands salivaire. Thèse de doct., Par., 1885.
9. DE LARABRIE. Arch. gén. de méd., 1890.
10. COLLET. Thèse de doct., Paris, 1895.
11. PONSOT. Tumeurs mixtes de la sous maxillare. Thèse de doct., Lyon 1894.
12. WILMS. Die Mischgeschwaelste, vol. iii. Berlin, 1902.
13. MASSABUAU. Rev. de chir., Paris, 1907, xxxvi; 389, 731.
14. WILSON and WILLIS. Am. J. M. Sc., 1912, cxliii, 656-670.
15. YAMIGAWA, KATSUSABURO, and ICHIKAWA, KOICHI. Mitt. a. d. Med. Fakult. d. k. Univ. Tokyo, 1915, xv, 295-344; 1917, xvii, 19-67; Japan. Ztschr. f. Krebsforsch, 1916, x, No. 4.

CYSTS AND PSEUDOCYSTS OF THE PANCREAS

With Report of Cases[1]

By A. A. KERR, M.D., Salt Lake City, Utah

THE term "pancreatic cyst" has been used to describe any fluid tumor, in or associated with that organ, though such tumors differ in etiology, position, and clinical manifestations. Cysts occurring in the upper abdomen are rare compared with cysts rising from the pelvis. The organs from which the cysts may arise are the pancreas, the kidneys and the suprarenals, the liver and the gall-bladder.

In the differential diagnosis the following affections will be considered: (1) the malignant disease of the pancreas or of the adjacent organs; (2) aneurism; (3) echinococcus cysts of the liver, spleen or peritoneum; (4) affections of the retroperitoneal lymphatic glands; (5) hydronephrosis or pyonephrosis; (6) cystic disease of the suprarenal capsule; (7) circumscribed peritonitis with exudation; (8) ascites; (9) cystic disease of the ovary; (10) hydrops of the gall-bladder.

Malignancy usually occurs in patients more than fifty years of age, although it may appear in a much younger patient. Large pancreatic cysts are unilocular, but if a malignant tumor has undergone degeneration, more than one cyst may be found. Hardness and irregularity of surface suggest malignancy; smoothness and regular round or oval contour speak in favor of a cyst. Occasionally, a rapid growing pancreatic cyst may develop much more rapidly than malignancy.

Aneurism. An aneurism of the abdominal aorta can be distinguished from a pulsating pancreatic cyst as its pulsations can be felt in all directions and a bruit is present. If the patient is placed in the genupectoral position, by gravitation the tumor will leave the aorta, and all pulsations will cease. Steady pressure will diminish the size of an aneurism but will have no effect on the cyst.

Echinococcus cysts of the liver or spleen may be mistaken for cyst of the pancreas. A peculiar fremitus which is sometimes felt on palpating an echinococcus cyst should always be sought. Hooklets in the aspirated fluid would be a positive indication of echinococcus cyst, while their absence would not exclude the possibility of the tumor being a sterile echinococcus cyst.

Tumors of retroperitoneal lymphatic glands. Inflammation, neoplasms, suppuration or enlargement of the retroperitoneal glands posterior to the pancreas might simulate a pancreatic cyst, but such conditions would usually give rise to serious constitutional disturbances and to extension of the disease to neighboring organs.

Hydronephrosis or pyonephrosis. In pyonephrosis, there may be an enlargement simulating a tumor but there is tenderness (readily elicited by percussion with the Murphy method), and intermittent fever with pyuria. In hydronephrosis, urinalysis shows usually albuminuria, oxalate of calcium and crystals of uric acid. The specific gravity is usually low, and the urine is generally alkaline or neutral in reaction. Cystoscopy with catheterizing of the ureters will assist in the diagnosis. Hæmaturia is rarely seen, except in cases of calculus. The X-ray should be used as routine in the diagnosis of these conditions. Tumors of the kidney usually occupy a lower place and are more laterally situated than tumors of the pancreas.

Exploratory puncture is condemned by modern surgeons, in the diagnosis of this type of tumor.

Cystic disease of the suprarenal capsule. The bronze skin is suggestive of disease of the suprarenal capsule. The blood pressure is usually low. About eight months ago I was called to see a doctor about 52 years of age, who was suffering from severe gastric symptoms, persistent vomiting and a slightly bronzed hue to his skin; no palpable tumor. On his temporarily recovering he left for Los Angeles where he had a home, although he was

[1] Read before the Western Surgical Association, Omaha, December 12–15, 1917.

practicing in Salt Lake City. Later advice from his attending physician showed a recurrence of his symptoms with a very low blood pressure. He improved temporarily on giving him solution adrenalin chloride, but he died a few weeks later. Autopsy showed cancer of the suprarenal gland and in addition carcinoma of the stomach.

Circumscribed peritonitis with exudation. Pancreatic cysts usually occupy the lesser peritoneal cavity or omental bursa. In circumscribed peritonitis there is usually fever, pain, and tenderness, which is more acute than in a cystic growth. Leucocytosis is generally found on examining the blood. Ascites is usually easily differentiated, although a cystic tumor filling the whole abdomen is sometimes misleading.

Cystic disease of the ovary. Several cases are reported of a large pancreatic cyst having been mistaken for ovarian cyst. About two years ago I was consulted regarding an old lady about 70 years of age, suffering from a large cystic tumor, filling the entire abdominal cavity. The history and physical signs pointed to its origin being in the left side of the pelvis. She refused operation and died a few weeks later. I secured permission to perform a partial autopsy, which showed a large cystic tumor filled with thick gelatinous fluid, originating from the left ovary and extending up to near the diaphragm. This tumor might have been mistaken for a cystic tumor originating in the upper abdomen or for an ascites.

Hydrops of the gall-bladder. Hydrops of the gall-bladder is located more to the right side and is attached to the liver.

The material upon which investigation of pancreatic cysts has been founded, has been rather scant. In the majority of cases dealt with surgically, a cyst has been opened, stitched to the abdominal wall, and drained. This has seemed to the operators to be the most prudent and desirable thing to do to minimize the mortality. Museum specimens of pancreatic cysts are rare; there is no doubt that in some cases when all the signs, physically and chemically, have been elicited, the cystic tumor has only a secondary connection with the pancreas. These have been described by Korte as pseudocysts, peripancreatic cysts.

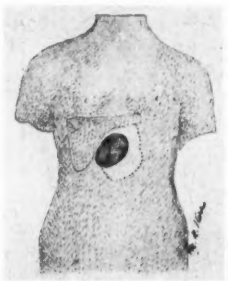


Fig. 1. Position of the pancreatic cyst in the author's case.

Pancreatic cysts may be classified as (1) retention cysts; (2) proliferation cysts — cystic adenoma, cystic epithelioma; (3) hydatid cysts; (4) congenital cystic disease; (5) hæmorrhagic cysts; and (6) pseudocysts. The last form is not a true pathological classification, but a convenient clinical term.

RECENT LITERATURE

Hirsh and Veeder[1] report a true cyst of the pancreas. At the operation the cyst was found in the lesser peritoneal cavity and was free from adhesions, being attached by a pedicle to the head of the pancreas. After removal the wall of the cyst was found to contain pancreatic tissue, and its contents showed the presence of enzymes.

Korte[2] reports six cases of inflammatory pseudocysts treated by marsupialization. Symptoms simulating gall-stone colic were elicited in these cases.

Dobson and Telling[3] have published a description of a pancreatic cyst, lined with cylindric epithelium, in a child of eleven.

Conolly[4] found a large pancreatic cyst in an infant 14 months of age.

In one case of pancreatic cyst reported by Albert and Page, the cyst emerged to the right through the foramen of Winslow into the greater peritoneal cavity.

Johnson relates a case where the cyst appeared in the left flank simulating a hydronephrosis.

Vellar in his work on the pancreas, gave records of 13 cases operated upon by evacuation and drainage in two stages. All the patients recovered, but one died later of diabetes, and in some a fistula persisted for several months. The opening and draining of the cyst had been done in 125 cases with 7 deaths.

[1] Univ. of Penn. M. Bull., 1910, May.
[2] Cent. Med. Work, 1911, 3–36.
[3] Brit. J. Child. Dis., 1909, vi, 202.
[4] Lancet, Lond., 1911, i, 803.

Fig. 2

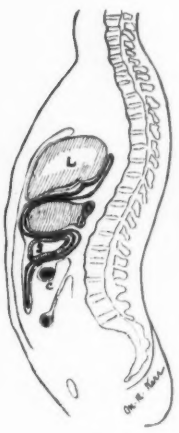


Fig. 3

Fig. 4

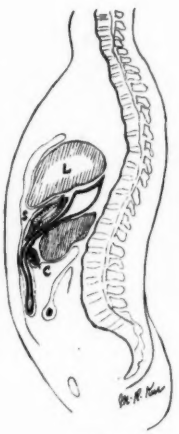


Fig. 5

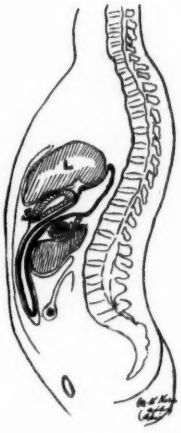


Fig. 6

Fig. 2. One of the positions in which a pancreatic cyst is found; behind the omental bursa and between the stomach and the transverse colon.

Fig. 3. A pancreatic cyst projecting forward behind the lesser peritoneal cavity between the stomach and the liver.

Fig. 4. The pancreatic tumor is sometimes back of the stomach.

Fig. 5. A pancreatic cyst below the stomach with the transverse colon lying in front.

Fig. 6. A pancreatic tumor below the transverse colon.

Several patients died later from diabetes. Total extirpation had been performed in 26 cases with 2 deaths. Besides these, 6 cases of hydatid cyst of the pancreas have been operated upon with no fatalities.

Pancreatic cysts are about equally frequent in men and women. The greater number of cases are said to occur between 20 and 40 years. Occasionally cysts are associated with pancreatic calculi.

Lazarus cites 41 cases with history of trauma.

Causes. Opie says: "The presence in cystic contents of one or more enzymes resembling those of the pancreas, was formerly believed to give proof that a cyst had its origin in the pancreas." Frequently all of these enzymes are absent in the contents of a pancreatic cyst, whereas, fat-splitting, diastatic or proteolytic enzymes are found in fluids not derived from the pancreas.

Symptoms. The symptoms depend somewhat on the size and location of the cyst. Stomach symptoms are frequent. A rounded, slightly fluctuating tumor in the epigastric region in close relation to the stomach, is suggestive. The tumor varies in size, often being the size of a child's head, and sometimes it may fill the entire abdomen. There is usually weakness and loss of weight. Diabetes is occasionally present as in the case I report. It showed 2 per cent glycosuria.

According to Korte, cysts of the pancreas may occupy a variety of situations, depending upon the relation of different parts of the gland to surrounding organs.

Variety of situations of pancreatic cysts. 1. In most instances the cyst growing forward presents upon the abdominal wall between the stomach and the colon, being covered by the gastric colic omentum which must be divided at operation. Pseudocysts are said to occupy this situation.

2. A cyst arising from the upper border of the pancreas may push its way between the lesser curvature of the stomach, which is pushed downward, and the liver, being covered by the gastrohepatic omentum.

3. The cyst especially when it is situated in the tail of the pancreas, may grow into the mesocolon separating its layers. If the cysts distend the upper layer of the membrane, the colon is pushed downward, and the tumor during life is found between the stomach and the colon; if the lower layer is distended, the transverse colon may be found along its upper border.

PROGNOSIS AFTER OPERATION

Johnson watched seven cases, all with postoperative fistulæ. All healed, some drain-

ing as long as three years. One of the cases under my observation, during the last year was operated upon about fourteen years ago in Los Angeles. It is still draining from the fistula.

SUMMARY

Pancreatic and pseudopancreatic cysts, while not rare, are of sufficient importance to be recorded.

The X-ray is an important aid in diagnosis in showing the position of the cyst in relation to the stomach and other organs.

The treatment is surgical, usually incision and drainage. Sometimes it is practical to remove the entire cyst in favorable cases.

Diabetes is an occasional complication of pancreatic cysts, and when present renders the operation more dangerous, although one should not hesitate when less than 4 per cent of sugar is present (C. H. Mayo) after giving a diabetic diet and a course of alkaline treatment to minimize the acidosis, to give even these the benefits of operations.

An antidiabetic diet is advisable following operations on the pancreas, especially where the discharge is irritating. Paraffin ointments are serviceable to allay the irritation.

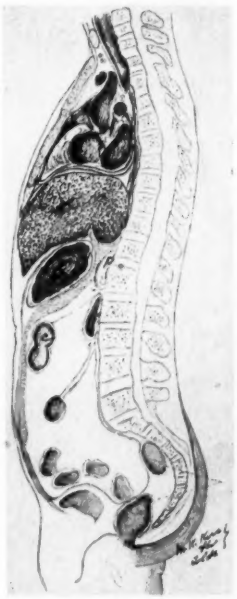


Fig. 7. Normal relations of the liver, stomach, transverse colon, and the duodenum.

CASE 1. Mrs. F., age 55; Irish parentage; native of America; widow seven years; occupation, housework; mother of three children. The patient's father died at the age of 98; the mother at 80. Two aunts died of cancers, one having cancer of the breast and one having carcinoma of the neck. She had six brothers and seven sisters; four brothers and two sisters died young; one sister died of pneumonia.

History. About 10 years ago the patient had a rather severe trauma as she fell down two flights of stairs. She states that some swelling in epigastric region developed after the fall. The patient was first seen in August, 1916, when a tumor in the right epigastric region was found. She then went on for six months before consenting to operation. By this time some pressure symptoms had developed; she complained of gastric fermentation and indigestion, when temperature and pulse were about normal. She complained of some weakness at times. A roentgenogram was taken by Dr. C. W. Stewart which showed the tumor lying to the right of the stomach in the upper right side of the epigastric region. Examination of the urine showed 2 per cent glycosuria. The patient was admitted to the hospital January 24, 1917, and operated on January 26, 1917. An incision about five inches long was made over the most prominent part of the tumor; the cyst was exposed. The walls were sutured to the parietal peritoneum. The contents were then evacuated; it contained about one gallon of a dark red colored fluid. A drainage tube was inserted, and the wound closed. The patient stood the operation well. Dr. J. Galigan examined the fluid contents of the sac but found no pancreatic enzymes. The patient made a satisfactory temporary recovery, and left the hospital February 5, 1917, the wound still discharging some. The sugar in the urine disappeared temporarily under strict diabetic treatment while in the hospital. On one occasion, after being at home for about two weeks, her daughter reported that some hair discharged from the wound. About two months later the discharge was quite copious, and believing that I could freely expose the cyst without danger, I decided to reoperate and drain in the right flank. Accordingly she was readmitted to the hospital. This time the cyst wall was freely exposed; the bowels being first carefully packed off. As much of the cyst as was possible was resected; the large drainage tube was inserted, coming out in the right side underneath the liver. This operation caused a marked improvement in her condition, though there is still a slight discharge from the fistula. The patient is now able to walk several miles and is comfortable.

The pathological report showed the cyst wall to be of the nature of a teratoma.

CASE 2. Mr. E. P., age 34; American; married; father of 2 children; occupation, weighmaster in

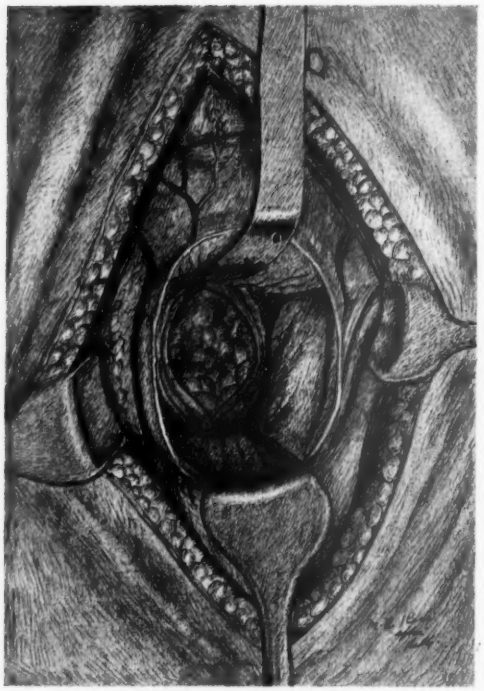


Fig. 8. Exposure of the pancreas, the two layers of the peritoneal cavity being incised and retracted.

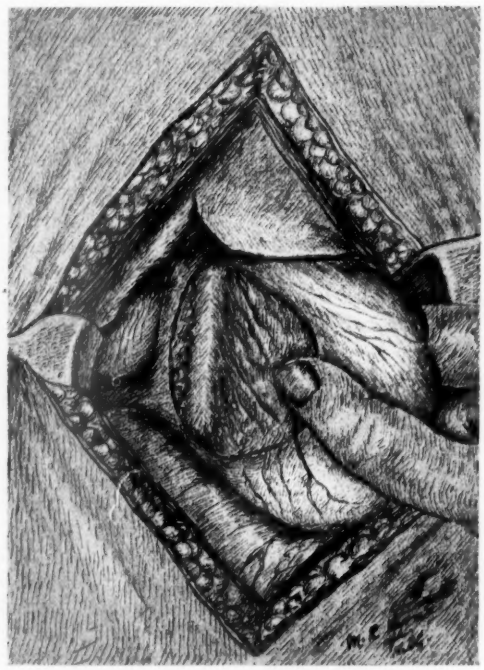


Fig. 9. Exposure of the head of the pancreas.

Garfield Smelter. His father is living and in fair health. The father had been operated upon for what was thought to be gall-stones, but none were found. The mother died of some liver trouble; one sister and one brother are living and well.

History. The patient's health was good until about 1903 at which time he was taken with colic-like pain, and vomited considerably. He was then living in Los Angeles. Dr. George Lasher of that city operated on him and found what was diagnosed as the pancreatic cyst; the cyst was sutured to the abdominal wall and drained. Drainage has persisted ever since but does not prevent the patient from working. It does cause him considerable inconvenience, as about half a pound of fluid is discharged daily from the fistula.

A sample of this fluid was sent to the Utah Wassermann Laboratory for analysis. The sample submitted for examination presented the following as reported by Dr. A. Blumberg: odor unpleasant; color, dull gray; specific gravity, 1.015; reaction, alkaline; albumin, 0.2 per cent; Fehling solution not reduced; alkalinity, 28 per cent expressed by cubic centimeters of tenth normal hydrochloric acid utilized; alkalinity due to carbonates. Enzymes present: proteolytic; lypolytic rennet. distinctly present; amylolytic in traces.

REFERENCES

KEEN. Surgery, vols. v and vi.
KOCKER. Operative Surgery.
BRYANT and BUCK. Surgery.
SENN. Pathology and Surgical Treatment of Tumors.
WATSON and CUNNINGHAM. Genito-Urinary Diseases.
TOLDT. Anatomy.
ROBSON and MOYNIHAN. Diseases of the Pancreas.
JOHNSON. Surgical Diagnosis.
KELLY and NOBLE. Gynecology and Abdominal Surgery, vol. ii.
BINNIE. Operative Surgery.

CONGENITAL RANULA OF THE TONGUE DEVELOPED IN THE LEFT BLANDIN–NUHN GLAND

By DR. RAMON TEJADA AGUIRRE, Guatemala, Central America.

CAREFUL observation in the case reported below has enabled me to form certain conclusions in regard to ranula of the tongue.

X. X., native of Gautemala, age 13, without any hereditary or personal antecedents of importance, showed a congenital tumor of the tip of the tongue, ovoid in form, and measuring 6 centimeters long, 4.5 centimeters broad, and 3.5 centimeters high. On inspection the tumor appeared translucent, with the upper surface smooth and normal in color for the most part, although bluish and black in places, especially about the middle, where there is an irregularly shaped ulceration with thick and callous edges and a reddish center which easily bleeds. The under surface of the tumor, smooth, lustrous and yellowish, shows the two ranulary veins of large volume with numerous branches. On palpation the tumor appeared resistant and slightly fluctuating. Aspiration drew some drops of thick, white, viscous fluid, without odor and with the characters of a mucous fluid.

On account of the large swelling, the patient could not keep her tongue within the mouth; moreover owing to its weight and projection the lower incisors were loosened and pushed outward; also undoubtedly owing to the fact that the mouth had been kept open for a long time, the condyles of the lower jaw had formed two neoarthroses in front of the glenoid cavities, i.e., two true irreducible luxations of the mandible, owing to which the patient, as seen in Figure 2, could not approximate the dental arches, thus leaving a semi-ovoid space between the two arches measuring 22 millimeters in its greatest width.

On this account and because of the excessive size of the tongue, the functions of this organ as well as those of the neighboring organs, were defective and liquid food only could be taken. Mastication in the true sense of the word was impossible, and the patient in addition to liquid food, could eat only soft substances, which could be made into a paste by the working of the tongue against the palatine arch. Deglutition could be effected only with difficulty. Saliva dripped constantly, giving rise to salivary hypersecretion. Owing to the constant moisture from the saliva on the patient's chin and breast, there were two eczematous placques which partly covered these regions. A very marked lisp was noted in the speech. The letter "r" was suppressed in words into which this consonant enters, and "rr" was changed into "j" in others. The tongue worked slowly and with torpor. There was marked hyperæsthesia in the organ in the region of the tumor, especially when the patient took any warm liquid food; but the patient suffered most from attacks of suffocation, which came on in the night time when sleep was most intense.

Fig. 1

Fig. 2

Fig. 3

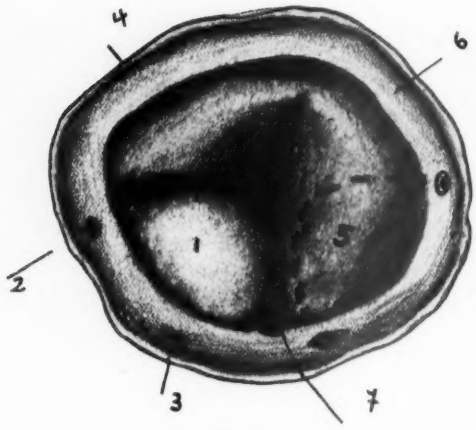


Fig. 4

Diagnosis. The resistance, slight fluctuation, and transparency of the tumor, as well as exploratory puncture clearly demonstrated the presence of a cyst. The nature of the liquid contained in the cyst walls, its congenital origin, its situation at the top of the tongue, where there are no other glands except those of Blandin-Nuhn made us suspect a congenital ranula of these glands. I say suspect because before operation we thought that the tumor could be as Tillaux[1] says, the prolongation or diverticulum of a sublingual ranula; or as Forgue[2] thinks, a congenital mucoid cyst developed from embryonal remnants made up of the anterior and transitory prolongation of the thyroglossal cord.

[1] Clinical Surgery, p. 249.
[2] External Pathology, ii, p. 249.

It was, therefore, with the idea that the cyst might have had any one of these three origins that we proceeded to operate. The operation very plainly showed after sectioning the top of the tongue (see Figs. 3 and 4) that the lingual ranula developed at the expense of the left Blandin-Nuhn gland, and that the right gland corresponded to the lumpy projection occurring in the interior of the cyst (Fig. 3). After sectioning the anterior wall of the cyst and evacuating its contents the interior was cauterized with silver nitrate, tamponed with iodoform gauze, and covered with a moist dressing, which was sustained very well owing to the protection and immobility of the tongue. On the second day the cyst wall, modified by the cauterization, was detached by hydrotomy, viz., by means of a stream of water ejected from an irrigator under strong pressure. By the twelfth day the cystic cavity closed, giving the tongue the form which is seen in Figure 5. Eight days later another operation was done by which a mass 30 millimeters deep, 5 high, and 15 wide was removed from the truncated point of the tongue. The tongue after suture of the lips of the wound, cicatrized in eight days with the form seen in Figure 6.

After resection the tongue recovered most of its functions. The only deformities which the patient now shows are the irreducible maxillary luxation (Fig. 2), and the dental changes.

From a study of this case we have formed the following conelusions:

1. Lingual ranula is developed at the expense of the Blandin-Nuhn glands, as Dubois, Blandin, Recklinghausen, Sonnenburg, Groos, Wright, Kirmisson, Keen, and the majority of writers have stated.

Fig. 5

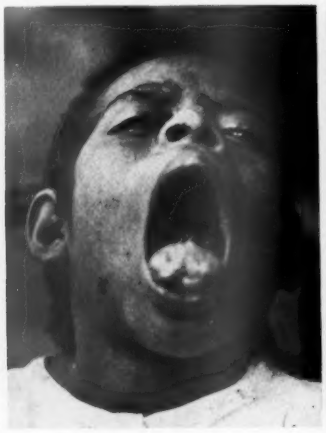


Fig. 6

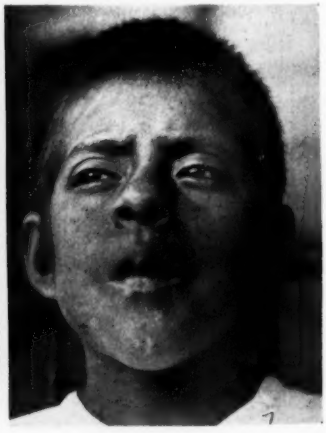


Fig. 7

2. This case not only disproves, but absolutely destroys the theory of Tillaux[1] who says: "I think there is but one class of ranula, always sublingual and primary, and that the suprahyoid is only a prolongation or diverticulum of the same." It also disproves or contradicts Forgue[2] who says with reference to ranula: "It may be admitted that its origin is contrary to the theory of Recklinghausen, according to whom ranula is developed in the Blandin-Nuhn glands."

3. This case absolutely disproves the idea that sometimes a lingual ranula, as Tillaux believes, can emit a prolongation or diverticulum into the anterior of the tongue; as well as contradicting the opinions of Forgue and Cuneo with regard to the formation of cysts in the tip of the tongue, arising from thyroglossal embryonal remnants.

4. Our humble opinion is that besides the lingual ranulas, the origin of which is described by Tillaux, Forgue, and Cuneo, other lingual ranulas may develop at the expense of the Blandin-Nuhn glands as the majority of authors believe and as the present case amply demonstrates.

[1] External Pathology, ii, p. 249.
[2] Clinical Surgery, p. 241.

GLOBOCELLULAR SARCOMA OF THE RIGHT TESTICLE. ORCHIDECTOMY UNDER LOCAL ANÆSTHESIA (ALLEN'S TECHNIQUE)

By Dr. RAMON TEJADA AGUIRRE, Gautemala, Central America

As malignant tumors of the testicle are so rare we would report the only case which we have observed during the past eight years.

X. X., native of Guatemala; age 30; butcher; married 12 years; came to consult me July 4, 1917. There were no hereditary or other antecedents of importance; he did not have syphilis, gonorrhœa, tuberculosis, or paludism. He never had hernia nor has he suffered from testicular traumatism.

His trouble began about 6 months ago and he noticed an increase in the size of the right testicle, which by degrees reached the excessive size shown in Figure 1. Because of its weight, the tumor produced a kind of dragging sensation in the cord and an intermittent pain in the lumbar region.

Examination. The patient is not emaciated and there is no abnormal tint to the skin. No adenopathy is present in the inguinal or other regions accessible to examination. There are no scars or spots on the skin. In the scrotal region there is a tumor, more globular than pyriform, which is 18 centimeters deep and 10 centimeters wide. Palpation of this tumor is not painful and discloses it to be soft in consistency, depressible, fluctuant in some regions, and hard and resistant in others. Even with both hands, it cannot be reduced within the inguinal canal; not the least sound of a gurgle can be detected. The surface of the tumor is quite smooth. Percussion shows absolute dullness in all parts. Testing for translucidity as in the case of hydrocele the tumor is found quite opaque. Aspiratory puncture draws only a few drops of blood. All the other organs are apparently normal.

Diagnosis. The following affections are suggested: (1) irreducible inguinoscrotal hernia; (2) hydrocele of the tunica vaginalis; (3) traumatic hæmatocele; (4) syphilitic testicle; (5) chronic hæmorrhagic vaginalitis or spontaneous hæmatocele; and (6) malignant testicular tumor. We immediately eliminate irreducible inguinoscrotal hernia of either the abdominal or abdomino-omental type owing to the solidity of the tumor. Besides, an epiplocele would not attain the size of this tumor without containing a portion of the intestine and would consequently give a sonorous note on percussion. Likewise we eliminate hydrocele of the tunica vaginalis, not only on account of lack of translucency (because it is known that there are opaque hydroceles due to the thickness of their walls or to the quality of the fluid contained), but especially because of the negative result given by exploratory puncture. Traumatic hydrocele is excluded as external signs of any recent injury to the scrotal region are wanting and the patient absolutely denies any traumatism. We can exclude syphilis of the testicle owing to the rapid evolution of this tumor, which, in a period of 6 to 8 months has attained dimensions which the syphilitic testicle never would reach in this length of time or only exceptionally in a longer period. Finally we discard without diagnostic discussion, tubercular and other orchitides since the tumor shows no resemblance whatever to them. There remain only two testicular affections: pachyvaginalitis,

a *b* *c*

Fig. 1. *a*, Photograph showing the size of the tumor; *b*, specimen removed; *c*, result of operation.

chronic hæmorrhagic vaginalitis or spontaneous hæmatocele of the tunica vaginalis, and malignant testicular tumor.

As we were unable to establish through clinical examination a definite diagnosis between the two affections, we decided to operate. Dr. Lizardo Estrada made the histological diagnosis of *globocellular sacroma of the testicle.*

Treatment. On July 7, under local anæsthesia, following the method of Allen,[1] a total orchidectomy was done, extirpating as much as possible of the cord.

The tumor weighed 680 grams including the fluid in the vaginalis, which weighed 150 grams. The testicle measured 9.5 centimeters long and 7.5 centimeters broad. The pathologic process invaded both the testicle and epididymis, only slightly modifying the ovoid form of the gland, but about tripling the volume. The tumor was quite bland in consistency. Its walls were formed solely of albuminous tissue and the contents were a pulpy substance similar to encephalic tissue, cream colored in some places and rosy or reddish in others. This substance weighed 280 grams. On expressing it a milky juice escaped similar to the juice from a cancer. In a word, the tumor showed all the macroscopic characters of a bland or encephaloid sarcoma. Histological examination, as we have said, established globocellular sarcoma. The specimen is preserved in the Anatomo-Pathological Museum of the Faculty of Medicine, Guatemala.

Ten days after the operation the wound cicatrized perfectly, as is seen in Fig. 3.

Prognosis. Two months later the patient was working at his trade as a butcher. It is very probable that there will be a fatal recurrence before two years, considering the prognosis in the case of malignant testicular tumor given by Bland Sutton[2] and by Arthur Dean Bevan[3] of Chicago.

[1] Local and Regional Anesthesia, p. 365.

[2] Keen's Surgery, vi, p. 122, and i, 860.

[3] Ibid., p. 623,vol. iv, 623.

THE PRESENT STATUS OF THE SURGERY OF THE BILE TRACT[1]

A Brief Review of the History of Bile-Tract Surgery

By ARTHUR DEAN BEVAN, M.D., F.A.C.S., Chicago

THE history of bile-tract surgery begins with the history of operations for gall-stones.

The existence of gall-stones was known ever to Hipprocrates and Galen. Occasional reports of incising gall-bladders and removing stones were made as long ago as 1700 and 1800. Bobbs of Indianapolis did a cholecystotomy in 1867. However, the real surgery of the bile tracts dates practically from the work of Marion Sims and Lawson Tait in 1878. In 1880 Langenbuch did the first cholecystectomy and in the same year did a cholecystenterostomy. In 1885 Charles T. Parkes of Chicago described fully the technique of choledochotomy, but this was not successfully done until 1889 by Courvoisier and a few years later McBurney did a transduodenal choledochotomy.

The operation for restoring the common duct by various plastic operations is a recent development. It is interesting to note some of the mile-stones in the development of this work. In 1884 in the *Journal of American Medical Sciences*, W. W. Keen and John Musser published an article reporting 3 cases, which they had handled jointly, of removing stones from the gall-bladder. They tabulated all the cases up to that time, 85 in number. One of the concluding sentences in their article is the following: "After revising these 85 cases we are very much surprised and gratified at the low mortality from these operations, the mortality being only 30 per cent." The progress made since that time probably in the same series of cases would today give a mortality of 3 to 5 per cent.

In 1898, in the Chicago Medical Society, we presented a symposium on this subject in which the following men took part: Fenger, Senn, Billings, Hektoen, Herrick, McArthur, and myself. I have lately reviewed that symposium and am surprised to find how completely it represents the present knowledge on this subject. The advances made in the last 20 years have been principally in the way of refinements in technique, and because of the experience gained in an enormous number of cases, our ability to make more accurate diagnoses, to decide for or against operative procedures and to better select the particular plan of treatment indicated in a particular case has been enhanced. In addition, the one special improvement which has been made in this field has been in plastic surgery for the restoration of the common duct.

I shall not go into the subject of pathology and etiology of bile-tract lesions. The conditions which demand surgical relief are gall-stone disease, acute infections of the bile tracts, chronic infections of the bile tracts, and neoplasms, especially carcinoma and lesions of the pancreas and other contiguous structures which either from invasion or from pressure interfere with the function of the bile tract. I desire especially to take up the subject of the diagnosis of these conditions and their treatment.

For the last 5 or 6 years, my medical colleagues and I at the Presbyterian Hospital have been making a scientific clinical research of these conditions and have attempted as far as we could to place both the diagnosis and the therapy on a firm scientific basis, and I shall attempt informally to present to you tonight the results of our investigations and operations. We have learned in attempting to make the diagnosis of a bile-tract lesion to place the first and greatest importance upon a carefully obtained history of the patient and have sought as far as we could to interpret correctly this history showing the relationship between clinical symptoms and the gross pathology, and I would without hesitation say that 80 per cent or more of the total value of the

[1]Presented before the Chicago Surgical Society, February 1, 1918. (For discussion see p. 100.)

evidence obtained that has helped to make a clinical diagnosis has been the accurate study of the history of the case.

The second important point is the attempt to exclude by a process of elimination conditions that simulate gross lesions of the bile tracts. Occupying the position of third in order of value I should place the physical examination of the patient. Fourth, the laboratory tests and fifth the X-ray findings. In regard to the latter, contrary to the position taken by a number of roentgenologists, we find the X-ray of little value in making a diagnosis of bile-tract lesions, of little value in determining the presence of gall-stones. In a small percentage of cases gall-stones are definitely shown in the X-ray, and this positive evidence is of value, but in such a large percentage of cases the gall-stones cannot be determined by the X-ray, and for the reason the absence of evidence is of little or no value in eliminating gall-stone disease. In making a diagnosis of bile-tract lesions there is another element that must be considered and it is the theory of probabilities.

To illustrate what I mean by this I would say that when a boy of 15 has an acute abdominal attack resembling in its clinical picture a gall-stone attack or an acute infection of the gall-bladder, we are inclined to regard it more as an appendiceal lesion situated high up in the abdomen than as a lesion of the gall-bladder. On the other hand when the same picture occurs in a women of 35 who has had children, on the theory of probabilities we are more apt to regard the case as gall-stones or infection of the bile tracts; and again in a man of 55 with the clinical picture suggestive of bile-tract lesion we take into consideration also the possibility of carcinoma. We rely in gall-stone cases, as far as locating the position of the stones, on the well known and accepted evidence that when the stones are limited to the gall-bladder, we have neither enlargement of the gall-bladder nor jaundice; with obstruction of the cystic duct, enlargement of the gall-bladder; with obstruction of the hepatic or common ducts, jaundice, either intermittent or progressive determined by the condition of the stone whether it is a floating stone or impacted. When jaundice is present we know that it is not due to a stone in the hepatic or common duct but to a stone in the gall-bladder with associated cholangitis, and we recognize also that when jaundice is present it may be due not only to gall-stones and cholangitis but to a number of other conditions; the jaundice of scirrhosis, the jaundice due to obstruction from carcinoma of the pancreas or carcinoma of the bile tracts themselves, the jaundice of syphilis involving the liver or the bile tracts. On the whole we have learned to respect the Courvoisier law that in jaundice from gall-stones in the common duct the gall-bladder is contracted in 80 per cent of the cases and that in jaundice from carcinoma of the pancreas obstructing the duct the gall-bladder is dilated in 80 per cent of the cases.

We have learned in the last 10 years a great deal about the relationship between bile-tract lesions and lesions of the pancreas. We have had a large number of cases in which even at the time of operation it was difficult to determine the exact character of the pancreatic lesions; whether they were inflammatory or carcinomatous. In a differential diagnosis between gall-stone disease and carcinoma the intermittency of the jaundice or the intermittency of the appearance of bile in the urine in gall-stone disease as compared with the greater persistence in carcinoma has been evident in most of our cases.

We have studied with a good deal of care those bile-tract cases in which it is difficult to differentiate between a bile-tract lesion and an ulcer of the duodenum or stomach. Here we have found the theory of probabilities of some service. In a man of 25 or 30 in which the differential diagnosis is clinically difficult we have found in the majority of cases that there is a duodenal ulcer, and again in a woman of 40 with the same picture the theory of probabilities points to gall-stone disease. We have been interested in a considerable group of cases in which we and some very well trained diagnosticians have made the clinical diagnosis of gall-stone disease and advised operation, and where at

the time of operation we have found no lesion of the bile tracts whatever, and no lesion in the immediate neighborhood of the bile tracts such as a duodenal ulcer that might fairly account for the symptoms. In some of these cases we have exposed the appendix through the same incision and if it is diseased we have removed it with the belief that the symptoms might have been appendiceal. In our early work we drained the gall-bladder in a number of cases feeling that there had been a low grade inflammation responsible for the symptoms. Of late years we have demanded very definite and positive evidence of an organic lesion before draining or removing any of these gall-bladders. I shall take this matter up more in detail in discussing the surgical therapy.

As to the selection of the time for operative interference if that is decided upon, we have felt that if there were no menacing condition the prognosis would be better if the patient is operated upon between attacks. On the other hand this method must not be carried too far and where the symptoms are suggestive of severe acute infection carrying with it the possibility of gangrene and rupture the case should at once receive surgical relief. In regard to choosing the time of operating on jaundice cases we have accepted the proposition, where possible, of operating between jaundice attacks. It is not always possible to do this but where the jaundice is prolonged and persistent it becomes necessary to interfere in spite of the greater risk that condition of cholæmia carries with it, both in lowered resistance and in the greater danger from hæmorrhage.

After careful analysis of a case, the question of deciding for or against surgical therapy must be answered. As our experience has broadened we become more radical, and at the same time more conservative if I can describe our present attitude by such a paradoxical phrase. We have become more judicial and have attempted to analyze each individual case as a separate problem weighing the evidence for or against operation, taking into consideration the risks of the pathological condition, the risks carried by the operation for the removal of this condition, the general condition of the patient, the age of the patient and the question as to how accurate the clinical diagnosis may or may not be. There can be no doubt as to the general advisability of removing a floating stone in the common duct that is producing intermittent attacks of jaundice. On the other hand in a woman of 70 or more with a bad heart, in poor general condition with infrequent attacks, the attempt at forming a judicial decision upon weighing the evidence often leads us to decide against operative interference and in favor of medical management.

As to the findings at the time of operation, how closely does our clinical diagnosis agree with what is actually found in the abdominal cavity when it is opened? My internal medical colleagues have in this clinical research made a definite clinical diagnosis before operation. They have made both a pathological and an anatomical diagnosis. We have found that they have been correct in more than 80 per cent of the cases and the percentage of correct diagnoses has increased in our work since we have undertaken this joint clinical study. The internal medical man is present at the operation and he sees the exact condition that has led to the symptoms in that case. These either confirm his previous opinion or lead him to alter his views as to the relation of these gross findings and the clinical symptoms making it possible for him more accurately to estimate the clinical findings in subsequent cases.

SURGICAL THERAPY

Our conception of the choice of procedures for gall-stone disease has changed a good deal in the last 5 or 6 years. Almost all of our operations are now either cholecystectomies or choledochotomies. With gall-stones in the gall-bladder or cystic duct we do now as the usual procedure an "ectomy." We seldom do an "otomy" and limit this procedure to cases with gall-bladders little diseased and without cystic duct involvement, to cases which are poor surgical risks, and to cases done under local anæsthesia. We are more and more regarding a diseased

gall-bladder containing stones in the same light as an appendix containing concretions, as a structure which should be removed in order to secure a permanent cure. We have had to so do many secondary operations after cholecystotomies where stones have been left in the cystic duct that we now hesitate to leave the gall-bladder where the local conditions and general condition of the patient make the removal reasonably safe. The increased frequency of removing the gall-bladder has brought with it an increased frequency of injury of the hepatic and common ducts especially in the hands of the less experienced operators. The moral is to make a wide exposure and to free the cystic duct fully and actually to see the duct itself before it is clamped and ligated.

There has not been much change in our method of choledochotomies except perhaps in the greater care with which we explore the ducts to be sure that no stones are left and to see that the passage into the duodenum is free and unobstructed. We, of course, make no effort to suture the incision in the duct and institute drainage with a No. 12 catheter introduced into the hepatic duct and sutured with ten-day catgut. We have learned to employ transduodenal choledochotomy wherever indicated and believe this a safer and more satisfactory operation than ordinary choledochotomy with external drainage.

In acute infections, empyema, of the gall-bladder without gall-stones we have sometimes simply drained the gall-bladder where the local and general conditions seemed to make the radical removal for the time being too dangerous. We prefer, however, where conditions warrant to do a primary cholecystectomy in these cases although undoubtedly in some the primary drainage and secondary cholecystectomy is the safest and best method. We do not recognize the necessity for surgical interference in the so-called chronic and subacute infections of the gall-bladder where there is no gross organic change evident in the gall-bladder itself, and where there is no obstruction of the cystic duct as shown by the fact that the gall-bladder can be easily emptied.

We have given up draining these gall-bladders as we have never seen any benefit result from draining them, and we never remove these gall-bladders as we do not recognize such a thing as a strawberry gall-bladder which of itself demands removal. The surgeon or internist has diagnosed gall-stones or an infected gall-bladder and when he finds no gross evidence of either he usually removes the appendix and drains or removes the gall-bladder. There is no more reason for removing such gall-bladders or draining them than there is for draining or removing a kidney which is the site of a mild pyelitis with a patulous unobstructed ureter. In mild gall-bladder infections with unobstructive gall-duct and without pus or gall-stones the process is curable quite as well by a drainage through the normal ducts as by external drainage through a rubber tube, and the real facts are that most of the cases in which the gall-bladder is removed or drained are cases of mistaken diagnosis and not infected gall-bladder at all.

As to cholecystenterostomy we have practically given up this procedure in gall-stone cases, although one must admit that in an exceptional case it may still find a place.

Next to gall-stones and acute infections, carcinoma has been the most frequent cause of bile-tract symptoms, and surgical interference is warranted. Carcinoma of the pancreas and stomach with resulting jaundice has in these cases been the most frequent finding at the exploratory operation. Here the silent course, the persistent jaundice and the distended gall-bladder form the typical picture, but the pictures are sometimes confusing and not infrequently the course is not silent but associated with a severe colic attack. The jaundice may be intermittent and the gall-bladder may be contracted simulating clinically the typical picture of obstruction of the common duct by stone.

Again in this same clinical group must be placed a good many cases of chronic pancreatitis presenting symptoms which often before the operation can not be differentiated from carcinoma or gall-stone disease. In fact even at the exploratory operation, as a rule, we have no means of telling whether a

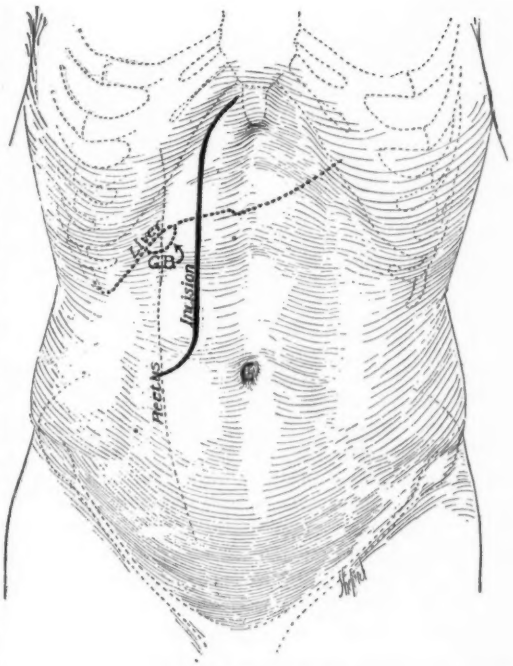
hard firm mass in the pancreas obstructing the common duct is carcinoma or a chronic inflammatory process. We have no reliable laboratory test to make this differentiation, and it is too dangerous to remove a section of the pancreas to obtain microscopic evidence of the pathology on account of the risk of hæmorrhage and fat necrosis. Where obstruction of the common duct from carcinoma or chronic inflammation of the pancreas is found the indication is either a cholecystenterostomy or a cholecystostomy. The one comfortable side of this picture is that in a surprising number of cases the process is not carcinoma but inflammatory and the patient recovers permanently with the establishment of drainage. We have had 20 or more of these cases, many of which we were confident at the exploratory operation were malignant but which have gone on to a permanent recovery.

Next in order of frequency is syphilis of the liver and bile-tracts. As a rule in these cases we have learned to make a clinical diagnosis without the aid of an exploratory operation. Sometimes, however, the picture is confusing and has led to an exploratory operation. The stellate retracted scars of syphilis of the liver when found are easily recognized. Recent gummata are also as a rule characteristic. Care should be taken not to remove any tissue for diagnosis unless this can be done without danger of secondary hæmorrhage. Serious and fatal hæmorrhages have followed such ill-advised attempts.

One of the most difficult and interesting chapters in surgery of the bile tracts is now being written, and that is the plastic repair of the hepatic and especially the common duct after injury, as a rule the result of operative interference. Usually the accident has occurred in a cholecystectomy. We have recently had the opportunity of studying several of these cases which are reported in the *Chicago Surgical Clinics*.[1]

And lastly in this résumé of the surgery of the bile-tracts, I want to refer in a general way to the operative technique. Nothing has impressed us more in this work than the necessity of a wide and free exposure. Have

[1] February 1918.



Author's S-shaped incision

you ever noticed carefully when watching some master of abdominal surgery doing some difficult, complicated work, apparently with ease and precision and assurance and without a slip or complication in the technique that he had made a wide and free exposure, that he was working to advantage because he first of all had taken the steps necessary to bring the structures involved completely and fully under his control? This is especially true of the surgery of the bile tracts.

In 1897, I introduced an S-shaped incision for this work. This has proved to be more successful even than we had hoped. We have learned to use it I think more safely and to better advantage as time has gone on. I have seen it so badly employed by some men and so badly described by others in textbooks and articles that I want to refer to it briefly. When properly made the incision gives the widest exposure with but little risk of resulting hernia, and it can be

readily modified to give either the small exposure needed in an exploratory operation, or the wide incision necessary to expose the most complicated bile-tract case, or even that required to do a diaphragmatic hernia, or the removal of an enormous spleen or abdominal tumor.

S-SHAPED INCISION

The incision should begin high up in the angle between the ensiform and the costal cartilage, pass downward and outward parallel with the costal cartilages, and about three-quarter inch from them to about the middle of the rectus. It then goes down the middle of the rectus almost to the umbilicus and then curves outward for two or three inches. The skin and superficial fascia are incised in this S-shaped line. The anterior sheath of the rectus is also divided in the line of the upper part of the curve and over the middle of the rectus. Unless a good deal of room is required, the rectus muscle itself is not divided but simply split parallel with the fibers. If, on the other hand, it is necessary to make a very wide exposure the rectus muscle is divided above at the upper and lower part of the S-shaped incision. At least half of the rectus muscle is left to the outer side of the incision so as not to interfere with its nerve supply.

In employing it for splenectomy on the left side the size of the S is determined by the size of the splenic tumor, a huge tumor, of course, requiring more room than a moderate sized tumor so that in some of the large splenic tumors the incision is carried well below the umbilicus before it is curved outward. It is important in order to obtain the full benefit of the incision to carry it well up in the angle between the ensiform and costal cartilage.

In conclusion I want to emphasize the importance of viewing such problems as we are discussing tonight as pieces of research, as pieces of scientific clinical research, of attacking these problems with an open mind with the assistance of our colleagues in internal medicine, our associates in laboratory and X-ray work. Looked upon as scientific research—studying the etiology, studying the pathology found at operation, attempting to establish the relationship of the clinical symptoms to the pathological picture, attempting to establish a rational therapy—viewed from this standpoint of scientific clinical research this work has not been routine hospital work. It has been a great joy, most interesting, most instructive. The younger well trained men who are beginning their surgical work at this time when surgery has been placed on a thoroughly sound and scientific basis have before them great opportunities, the opportunity of attacking with the organized trained forces of scientific clinical research the many unsolved problems that still confront us, and of finding solutions which will save lives and relieve suffering. Viewed from the standpoint of scientific clinical research the modern sciences of diagnosis and therapy make the practice of medicine and surgery no longer the work that merely wins your daily bread, but the most fascinating, the most productive field of human effort.

SURGERY OF THE POSTERIOR SPINAL ROOTS

With Summaries of Results in 244 Operations[1] [2]

By CARL R. STEINKE, M.D., F.A.C.S., Akron, Ohio
Surgeon to the Akron City Hospital and the Children's Hospital

SURGERY of the posterior spinal roots dates back 28 years when, on December 31, 1888, Dr. Robert Abbe (1), of New York, performed root resection at the suggestion of Dr. C. L. Dana, for intractable neuralgia of the right brachial plexus. Abbe reported his case February 9, 1889, and on April 23, 1889, appeared the report of a case of persistent neuralgia operated upon by Mr. Bennett (2) of London, at the suggestion of Mr. Horsley. The operation was performed 7 days prior to Dr. Abbe's, but 3 months after Dr. Dana suggested it.

Foerster (3) of Breslau, in 1908, reported the operative technique for cases of spasticity and tabetic crises, which bears his name. Later Foerster (4) altered his technique somewhat and used the electric current to differentiate the anterior and posterior roots, while the patient was in deep narcosis. He also recommended the resection of more roots than previously.

In view of the severe traumatism occasioned by Foerster's operation, Van Gehuchten (5) sought to simplify the procedure by resecting only some root fibers of each large root whose fibers connect with the lower limb.

Wilms (2) modified this technique by transferring the field of operation to the lumbosacral region. Only a certain portion of each root is removed and unless the root consists of only one bundle, at least one bundle of each root is left intact.

RESULTS OF POSTERIOR ROOT RESECTION FOR SPASTICITY

Operations for spasticity should be done only in severe and extreme cases. Orthopedic measures, such as tenotomy and plastic operations on the muscles and tendons followed by training, first, should be given a thorough trial. Training must necessarily follow operation. Idiots and imbeciles should not be operated upon.

The length of time the spasticity existed before operation in the 132 collected cases ranged from 1 month to 28 years, with an average of 8.6 years. This includes 9 cases of the Van Gehuchten technique and 6 of the Wilms method. There was considerable variation in the number of roots resected in the different cases; two roots were resected in 2 cases, three roots in 44, four roots in 53, five roots in 10, six roots in 2, seven roots in 1, and in 20 the number was not stated.

The areas affected by spasticity were, upper extremity, 4 cases; lower extremity, 77; upper and lower extremity, 44; neck, 2; and for 4 cases the areas were not mentioned.

The prognosis according to the cause of spasticity is shown in Table I.

The causes of death were as follows: operative (those within one month after operation), loss of cerebrospinal fluid 1, meningitis 5, cardiac paralysis 1, general tuberculosis 1, shock 1, acute enteritis 1, cause not stated 4; late (after one month), erysipelas and meningitis 1, meningitis 1, pulmonary tuberculosis 1, inanition 2.

TABETIC CRISES

Prognosis as to duration of crises: There is not much difference, those existing from 5 to 10 years or longer showing as great a percentage of improved as those of 1 to 2 years duration (see Table II).

The duration of the crises before operation for the 47 cases where the time was given varied from 10 months to 25 years, with an average of 6 years. Of the 55 patients where the age was given, 45 were between the years of thirty and fifty, 5 in the twenties, 3 in the fifties, and 2 over sixty. There were 44 males, 15 females and in 14 the sex was not stated (see Table III). The roots were resected intra-

[2] The cases summarized in this paper were collected for Dr. Charles H. Frazier, of Philadelphia and I am greatly indebted to him for the privilege of reporting them. It includes all reported cases we could find up to June, 1915.

[1] Read at the Sixth Councilor District Meeting, Ashland, Ohio, November 14, 1916.

TABLE I. — POSTERIOR ROOT RESECTION FOR SPASTICITY. PROGNOSIS FOR ALL TYPES OF SPASTICITY.

Cause of Spasticity	Total	Cured	Improved	Unimp.	Death	
					Oper.	Late
Cerebral diplegia	70	2	56	3	9	
Infantile spasticity (mono-, di-, tetra-, para-, and hemiplegias)	35		25	6	3	1
Lateral sclerosis	9		5		2	2
Multiple sclerosis	6		4	1		1
Wry-neck	2	2				
Traumatic	3		2	1		
Pott's disease	2		1			1
Tumor	2		2			
Hemiplegia (adult)	3		2			1
Total	132	4	97	11	14	6

Imp. = Improved, Temp. Imp. = Temporarily improved, Unimp. = Unimproved, Oper. = Operative death, D. = Dorsal, L = Lumbar. Figures in ( ) indicates the number of roots resected.

durally in 54, extradurally in 9, and the method was not mentioned in 10.

The results up to one year after operation were as follows: cured, 14; improved, 31; temporarily improved, 6; unimproved, 5; died, 16; not stated, 1. Prognosis as to the location and number of roots resected is shown in Table IV. Of the cases reported cured there was one for each of the following months; 2½, 3, 5, 6, 10½, 11½, 14, and 28, and for 6 the time was not given. For those reported improved the time in months was one for 1, 15 and 18, two for 1½ and 6, and four for 3 and 5 months, while for sixteen the time was indefinite.

TABLE II. — PROGNOSIS AS TO DURATION OF CRISES.

Duration in Years	Total	Cured	Improved	Temp. Imp.	Unimp.	Death			Not Stated
						Oper.	Late		
							Imp.	Unimp.	
Less than 1	3	1		1	1				
1 to 2	4	1	2	1					
2 to 5	17	2	7	1	2	2	2	1	
5 to 10	20	2	9	1	1	4	2	1	
10 to 20	5	2	2	1					
20 to 30	1		1						
Not stated	23	6	10	1	1	4			1
Total	73	14	31	6	5	10	4	2	1

TABLE III. — SEX AND AGE IN TABETIC CRISES CASES.

Sex	Total	Age in Years					
		20–29	30–39	40–49	50–59	Over 60	Not Stated
Male	44	4	14	17	1	2	6
Female	15	1	1	10	2		1
Not stated	14		3				11
Total	73	5	18	27	3	2	18

The most distressing symptoms of the crises, pain and vomiting, were affected as follows: pain relieved in 22, temporarily relieved in 9, lessened in 29, relieved to the time of death 7, unrelieved 7; vomiting relieved in 21, temporarily relieved in 6, lessened in 25, relieved to the time of death 7, unrelieved 4.

The importance of a careful diagnosis is illustrated by 4 cases who had had previous gastro-enterostomy, 2 cholecystectomy, 1 cholecystotomy, and 2 negative exploration.

The complications following operation were

TABLE IV. — PROGNOSIS AS TO THE NUMBER OF ROOTS RESECTED.

Inclusive Roots Resected	Total	Cured	Imp.	Temp. Imp.	Unimp.	Death			Not Stated
						Oper.	Late		
							Imp.	Unimp.	
4 to 8 D. (5)	1	1							
4 to 12 D. (9)	1					1			
5 to 8 D. (4)	1				1				
5 to 9 D. (5)	2	1	1						
5 to 10 D. (6)	3	1	1	1					
6 to 9 D. (4)	4	1	1				2		
6 to 10 D. (5)	5	1	2		2				
6 to 11 D. (6)	1				1				
6 to 12 D. (7)	1	1							
6 D. to 1 L. (8)	1					1			
7 to 9 D. (3)	16	2	7	2	1	2	1	1	
7 to 10 D. (4)	22	4	11	1		3	1	1	1
7 to 11 D. (5)	4	1	3						
7 D. to 1 L. (9)	1		1*						
8 to 10 D. (3)	1			1					
10 D. (1)	1		1						
10 to 12 D. (3)	1		1						
Not stated	7	1	2	1		3			
Total	73	14	31	6	5	10	4	2	1

*Two operations.

TABLE V. — PROGNOSIS OF ROOT RESECTION FOR PAIN.

Cause	Total	Cured	Imp.	Unimp.	Death	
					Oper.	Late
Neuralgia or neuritis	28	6	8	2	4	3
Pressure	8		1	1	1	5
Amputation pain	3	1		1	1	
Total	39	7	9	4	6	8

paralysis of the lower limbs, 5 cases (2 were temporary); thrombosis of the lower limb, 1; paralysis of the bladder, 5 (3 were temporary); paralysis of the rectum, 1; cystitis, 4; pyelitis, 2; pulmonary embolus, 2; bulbar paralysis, 1; cardiac paralysis, 1; meningitis, 3; pneumonia, 1; and shock, 1. One patient became pregnant after operation and aborted.

Operative deaths (deaths within one month after operation) were meningitis, 3; pneumonia, shock, pulmonary embolus, cardiac paralysis, cystitis, persistent diarrhœa, hæmatorrhachis, 1 each. Deaths later than one month were from degeneration of the posterior roots and horns, 1; bulbar paralysis, 1; pulmonary tuberculosis, 2; and cystopyelitis, 2.

The results of operation for the various types of pain are given in Table V.

In conclusion, it was found there were 47 different operators so that no one man's technique can be accredited with the general good results. The amount of root resected varied from 3 millimeters to 3 centimeters. In the spastic cases 4 were cured, 50 greatly improved, and 47 somewhat improved. In the tabetic cases 14 were cured, and 37 improved. Operation for pain gave 7 cures, and 9 improved out of 39 cases. When one considers the gravity of the operation the mortality is not high. With these facts at hand we may conclude that the operation of resection of the posterior spinal roots, when properly carried out, is one of great value to the patient and should be performed more frequently.

REFERENCES

1. ABBE, R. A contribution to the surgery of the spine. Med. Record, 1889, xxxv, 149–152.
2. IDEM. Resection of the posterior roots of spinal nerves to relieve pain, pain reflex, athetosis, and spastic paralysis. Med. Record, 1911, lxxix, 377–381.
3. FOERSTER. Ueber eine neue operative Methode der Behandlung spastischer Laehmungen Mittels Resektion Hinterer Rueckenmarkswurzeln. Ztschr. f. orthop. Chir., 1908, xxii, 203.
4. IDEM. Die Behandlung spastischer Laehmungen Mittels Resektion hinterer Rueckenmarkswurzeln. Verhandl. d. deutsch. Gesellsch. f. orthop. Chir., 1912, xi, 269.
5. VAN GEHUCHTEN. La radicotomie postérieure dans les affections nerveuse spasmodique (modification de l'operation de Foerster). Bull. Acad. Roy. de méd. de Belge, 1910, xxiv, 860.
6. WILMS and KOLB. Modifikation der Foersterschen Operation Resektion der Wurzeln am Conus Medullaris. Muenchen. med. Wchnschr., 1911, lviii (2), 1961.

A STUDY OF THE FRACTURES OF THE LOWER EXTREMITY OF THE HUMERUS[1]

By HERMAN A. H. BOUMAN, M.D., F.A.C.S., Minneapolis, Minnesota

THE lower end of the humerus is flattened from before backward, terminating below in a sloping articular surface which is subdivided by a low ridge into the trochlea and the capitellum. Projecting on either side from the shaft are the condyles. The internal condyle is large, and far the more prominent; the epicondylus internus is that part of it which lies outside of the joint, giving attachment for the pronator radii teres, the flexors of the hand, and the internal lateral ligament. Over the posterior surface runs a smooth groove to accommodate the ulnar nerve. The external condyle represents the capitellum, part of the trochlea, and the epicondylus externus. This body gives attachment to the supinator brevis and the extensors; while, unlike the other side, the external lateral ligament is attached to the outer margin of the capitellum.

The capsular ligament, another important structure with relation to fractures, is attached in front of the humerus above the articular surface and the coronoid fossa in an inverted V-shaped manner to two very faintly marked ridges which arise from the front of the internal condyle to meet above the coronoid fossa. Posteriorly the ligament is thinner, but is attached in a like manner, ascending from the internal condyle along the inner side of the olecranon fossa, descending along the outer margin to the trochlear surface, then turning outward along the posterior edge of the capitellum. The lateral bands are very strong and play an important rôle. Remembering that the surface of the joint looks forward, we have also to appreciate that the muscular structures and their septa, especially lacertus fibrosus (of the biceps) can exert a compressive force upon the joint surface.

The normal movements of the joint are flexion and extension, those of a true hinge joint; yet, when the forearm is flexed onto the humerus it is inclined inward, the hand reaching about the middle third of the clavicle; when the forearm is extended it inclines outward, forming the so-called carrying angle. The limit of extension is reached when the ulna is nearly in a straight line with the humerus. When it describes an angle of 30° to 40° with the humerus, the limit of flexion has been reached. The obliquity of the movements is caused by the outward inclination of the upper and back part of the trochlear surface and the greater prominence of the inner lip of the trochlea below; thus the plane of motion is directed inward and forward from behind. In one of my little patients a supracondylar fracture healed in such a way that the normal obliquity, and, with it, the carrying angle were lost, while all normal movements of the joints were free and easy. The importance of the carrying angle is not to carry things, such as a pail of water, but to bring things to the mouth in the best possible way.

At birth the inferior extremity of the humerus is cartilaginous throughout, ossifying slowly from four epiphyseal centers. Among the injuries of the elbow, fractures preponderate in childhood as against dislocations in adult life, this being due, according to Professor Kocher, to the lateness of ossification and the serial advance toward complete coalescence. At about the end of the second year, there appears the first nucleus of bone in the capitellum; the second nucleus appears in the epicondylus medialis during the fifth year; the third, during the tenth or twelfth year in the trochlea; and the fourth, about the thirteenth year in the epicondylus lateralis. From Farabœuf's studies we learn that the bony center of the trochlea coalesces quite early with the bones of the diaphysis, while the nucleus of the capitellum joins with that of the lateral condyle. The bony center of the internal epicondyle remains isolated up to the thirteenth or sixteenth year. For a long time, then, there are two possible lines for

[1] Read before the Hennepin County Medical Society, Minneapolis, Minnesota, November 5, 1917.

epiphyseal fractures; one between the trochlear shaft bone and the capitellum and external condyle combination; the other between the internal epicondylar body mesially and the trochlear shaft bone laterally. These lines are readily rediscovered in practice. It is, therefore, anatomically explained why fractures through the condyles (Kocher's fractura diachondylica) have not been seen after the fourth year, while fractures along the lines mentioned above occur as late as the sixteenth year.

It seems profitable to divide the fractures into two classes: (1) the most frequent; and (2) the least frequent.

1. *The most frequent* comprise the supracondylar fractures and the fracture of the external condyle.

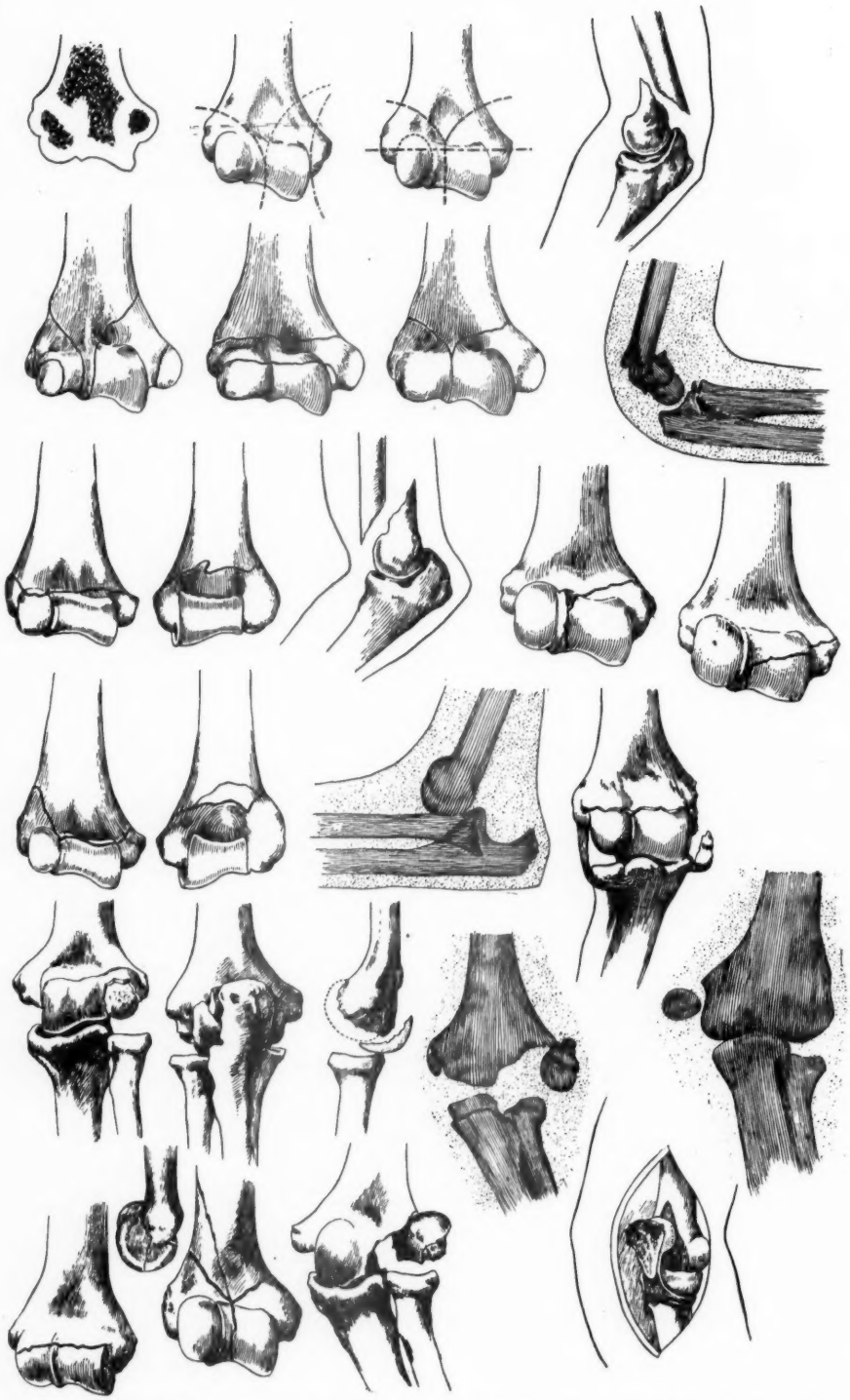
A supracondylar fracture means a transverse separation of the lower end of the diaphysis close above the condyles. Kocher has artificially effected this fracture by holding the lower end of the humerus in a vise and forcibly extending or flexing the forearm. By holding the end of the forearm on a board, the elbow flexed at a right angle, and then dropping a heavy weight upon the back of the lower humerus, a supracondylar fracture was produced. Fixing the condyles in a vise and flexing the diaphysis forward, or fixing the lower humerus and rotating outward results in supracondylar fracture.

The line of separation gives two clinically distinct pictures, depending entirely upon whether the pinch is placed posteriorly or anteriorly. A stick of sound wood cannot be broken perfectly square by holding it over a hard edge. The line of fracture runs away from the point of pinch. In the extension fracture the pinch is from the capsular ligament insertion in front, and lateral ligaments, in which case the line of fracture runs from there up (anterior low, posterior high). The upper fragment slides down over the lower one and the clinical picture of a posterior dislocation of the elbow is deceivingly real. One of the writer's patients held his hand against a post of a gate and an animal ran against his arm from behind, so that he sustained a supracondylar fracture. However, that is not the usual way of procedure; as a rule, they result from a fall on the hand of a half-extended forearm and the stress is on the capsular ligaments and muscular attachments.

With the fracture by flexion, the pinch is behind. In this case, also, the line runs up, but not posteriorly low and anteriorly high. The upper fragment slides down over the lower part, but not so far as to liken luxation since the taut drawn triceps limits this movement. These fractures come about by falling on the flexed elbow. The sharp fragments may easily cause complications by cutting skin and muscles, inducing infection. Even vessels and nerves have been cut.

The fracture of the external condyle is second in frequency. It means a separation along the epiphyseal line of the shaft from a part of the trochlea, the capitellum, and the epicondylus externus. This has been artificially effected (Kocher) by compressing the humerus, fixed in a vise, so that it appeared as if the external condyle had less resistance than the inner condyle. Another means of procedure was to force the radius against the capitellum, with the elbow in flexion. Clinically this fracture results from a fall on the hand of the bent and pronated arm, or a fall on the outstretched hand, the force being received and transmitted by the radius. From a fall on the elbow, the arm being in abduction, this fracture obtains if the capsule breaks at its mesial insertion so that the turning out of the olecranon forces the external condyle to give way.

The fracture of the inner epicondyle is the pulling or tearing off of the prominent bony process of the inner condyle by the strong internal ligament inserted at its base; if the bone holds, the ligament parts and a posterior dislocation of the forearm presents. A very small laceration of the capsular ligament over the trochlea suffices to make the dislocation possible. It may be replaced spontaneously, or even may be made or unmade at will. The writer saw Professor Kocher demonstrate such a case. It is clear, then, why this fracture occurs with luxation or may be a stepping stone to it. This injury may take place in several ways: (1) falling on the hand of the abducted, outstretched and hyperextended arm; or, (2) upon the elbow, the forearm bent



Typical forms of the fractures of the lower extremity of the humerus. (The illustrations are taken from several books, principally from Kocher and de Quervain.)

and the humerus abducted, will indirectly effect this fracture by stress on the lateral ligament and muscular structures; (3) it may result from falling backward with the hand held behind the back so that the whole weight is brought to bear upon the prominent epicondyle. We are cautioned (Kocher) to look for this fracture also in combination with more severe and extensive injuries, such as the "Y" and "T" types.

2. *The least frequent fractures.* The fracture of the inner condyle is a separation of the shaft from the inner condyle. Anteriorly, the line runs through a part of the capitellum and, posteriorly, through the trochlea. When falling upon the adducted arm, the olecranon pinches the condyle out of position; the instinctive thrust of defense usually puts the arm away from the body and that may be the reason why this fracture has not been observed often. As in other large joints, there are two intracapsular fractures of the elbow: (1) the one goes through the condyles below the epicondyles (Kocher's fractura diachondylica); (2) the other is a partial fracture of the capitellum.

In the former the whole surface of the joint with its cartilaginous covering is moved off of the humerus; in the latter, the capitellum is barked and the peeling of bone and cartilage is displaced, usually forward, within the joint cavity. These injuries could not occur without a lack of bony resistance as an etiological foundation. The fractura diachondylica has been observed only in young children, from two to five years of age, and the injury of the rotula seems to occur in individuals who have some bony changes. One is instinctively reminded of the knee-joint where the loose bodies may lock it.

When extraordinary forces bring about injuries at the elbow, the greater or lesser resisting capacity of the bone ceases to be a recognizable directing factor for the line of separation. Compound and complicated fractures result; among them two principal types are recognized, the "Y" and "T" forms. The former is the separation of the condyles from each other and from the shaft; the latter means a supracondylar fracture with an added separation of the condyles from each other.

With these facts in mind it is evident that a clear-cut diagnosis may be a safe director of a successful management. Valuable as are the roentgen rays, they are not indifferent in their effect on growing bone and, therefore, the time of exposure should be brief and as infrequent as practicable. Both elbows should be rayed as the control is of much use. Owing to the many cartilaginous lines, it is well to be guarded. For greater efficiency and for better judgment the older methods of examination should also be employed.

Unless the injury has been brought about by extraordinary force, it is in early youth that these fractures usually occur. The true intracapsular fracture (diachondylica) has not been seen later than the fourth year. After the period of growth, only a few supracondylar fractures have been reported.

Excellent clues should be found in the manner in which the patient met with his accident. The bones being thin in children and the swelling often extensive, accurate palpations are exceedingly difficult and a good history is therefore much appreciated. Man's upright walk is acquired; to maintain this position the center of gravity lies forward, thus a child falls very often. Forward falling, with instinctive defensive action of the arms, is far more frequent than backward or sidewise falling. If injury is sustained, its form is in relation to the most frequent manner of falling; thus the fracture most common is the supracondylar, produced by falling forward upon the hand, which brings the whole weight to bear upon the lower humerus where the capsular ligament during overextension directs the line of fracture. If the falling forward occurred upon the bent elbow, the lower humerus again must take the full blow, the line of fracture being given by the capsular ligament being forced into overflexion. Falling upon the half bent elbow of the abducted arm is also common, in which case either the olecranon directly, or the radius by the palm of the hand indirectly, brings the blow to bear upon the external condyle. That the arm should not have time for defense is unusual, so that a sudden fall upon the adducted arm, striking the prominent part, the olecranon, or the internal condyle, and causing fractures, is

STUDY OF THE FRACTURES OF THE LOWER HUMERUS

Age, History, Inspection	FREQUENT			INFREQUENT							
	Fractura Supracond. extensione	Fractura Supracond. flexione	Fractura Condyli externi	Fractura Epicondyli interni	Fractura Epicondyli externi	Fractura Condyli interni	Fractura Y & T	Fractura Dichondylica	Fractura facies Rotulae	Distortio	Luxatio posterior
Age											
1– 4 years	May occur	May occur	May occur	May occur	May occur	May occur	Not known	Not known after 4-yrs	Rare	All ages	All ages
2–16 years	May occur	May occur	May occur	May occur	May occur	May occur	Rare	Not known after 4 yrs.	Rare	All ages	All ages
All ages, adults especially	Rare	Rare	Rare	Rare	Rare	Rare	The rule	Not known after 4 yrs.	Usual	All ages	All ages
History											
Injury resulting from Extraordinary force							Always				
Normal force striking through forearm Directly											
Arm abducted	Whole lower humerus	Whole lower humerus	One side by radius			One side by ulna					
Arm adducted						By ulna					
Indirectly, transmitted by capsular ligament											
Entire capsule in over-extension	Usual	In flexion						Overextension			
Part of capsule in abduction and extension				Usual often with dislocation		May occur					
Part of capsule in adduction and extension			Usual dislocation rare			Usual often with displacement					
Inspection											
Patient carries limb	Supported	Supported	Not supported	Not supported	Supported if with dislocation	Supported if uncomplicated	Supported				Supported
Relation of axis of forearm to humerus	Carrying angle lost	Carrying angle lost	Carrying angle reversed	Unchanged	Carrying angle reversed	Exaggerated	Lost	Lost	Unchanged	Normal	Normal after reduction
Contour of joint Swelling	Uniform all over joint	Uniform all over joint	May be large but lateral	Mesial if uncomplicated	Lateral	Mesial	Large uniform	Little	Very little or none	Uniform all over joint	Uniform all over joint
Prominent bony points: olecranon, condyles and their relations	Olecranon prominent normal in size and relation	May be exaggerated bony prominence above olecranon	Olecranon and int. cond. correct; ext. cond. changed or gone	May be dislocation if not prominent int. epi. cond. gone	Change internal to external	Relation of olecranon to condyles changed	Large swelling with or without ext. complication	Normal appearance	Olecranon may look large	Normal	Relation of olecranon to condyles changed

Function test and palpation	Frequent			Infrequent							
	Fractura Supracond. extensione	Fractura Supracond. flexione	Fractura Condyli externi	Fractura Epicondyli interni	Fractura Epicondyli externi	Fractura Condyli interni	Fractura Y & T	Fractura Dichondylica	Fractura facies Rotulae	Distortio	Luxatio posterior
Movements											
Normal Extension	More than free	Normal	Normal	Normal	Normal	Normal	Entirely movable: passive motion only	Locked joint	Free unless locked	Free	Impossible
Flexion	To right angle	To right angle	Normal	Normal	Normal	Normal		Locked joint	Free unless locked	Free	Only to right
Supination	Normal	Normal	Abnormally free	Normal	Abnormally free	Normal	Entirely movable: passive motion only	Normal	Free unless locked	Normal	Normal
Pronation	Normal	Normal	Abnormally free	Normal	Abnormally free	Normal		Normal	Normal	Normal	Normal
Abnormal Abduction	Movements: Both condyles may be moved free against shaft and crepitation established	Both condyles may be moved free against shaft and crepitation established	Normal	Abnormal	Normal	Abnormally free	Bag of marbles	None	None	None	None
Adduction			Abnormally free	Normal	Abnormally free	Normal	Bag of marbles	None	None	None	None
Anteroposterior mobility			None	None	None	None	Bag of marbles	None	None	None	None
Palpation Push pain	Present no matter how forearm stands	Present no matter how forearm stands	With forearm in adduction	May be absent unless capsule torn	Absent unless capsule torn	With forearm in adduction	Present	Present	In adduction	Absent	Absent
Traction of forearm	Straightens joint	Straightens joint	No change	No effect	No effect	No effect	Straightens joint	No effect	No effect	No effect	No effect
Internal epicondyle and condyle	Normal in size and form	Normal in size and form	Normal	Gone	Normal	Changed	Changed	Normal	Normal	Normal	Normal
External epicondyle and condyle	Normal in size and form	Normal in size and form	Changed or lost	Normal	Roughening	Normal	Changed	Normal	Normal	Normal	Normal
Olecranon	Normal in size and contour	Normal in size and contour	Normal	Normal	Normal	Normal	More bulky Loose bone with it	Normal	Broader because of bone shell	Normal	Normal
Relation of the three in flexion and extension	Relations normal	Relations normal	Ext. condyle and olecranon changed	Changed	Changed slightly	Ext. condyle nearer olecranon	Changed	No change	No change	No change	Olecranon out too far from normal condyles
Radius head	Moves normally	Moves normally	Too high and condyle moving with it	Normal	Normal	Sharp edge near olecranon	Changed	Impossible to flex	Joint may be locked	Normal	Extension impossible
Relation of radius and ulna	Normal	Normal	Condyle moving with it	Normal	Normal	Sharp edge near olecranon	Normal	Flexion impossible	Joint may be locked	Normal	Extension impossible
Presence of abnormal bony prominences	Sharp fragment may be felt in front of joint		Rough bony surface	Normal	Normal	Sharp edge near olecranon	One may find almost anything	Sharp fragment felt near olecranon	Displaced bone near olecranon	Nothing abnormal	Nothing abnormal

unusual. If a young child falls upon its fully outstretched hands, the muscular structures and the capsular ligament exert such a compressive force that the whole articular cartilage with an adherent bony shell may peel off, producing a true intracapsular fracture.

With an accurate history, we turn to inspection, restraining the almost irresistible impulse to grab the victim. Usually, when serious injuries are sustained, with his good hand the patient carefully supports his elbow in light flexion. In supracondylar fractures the arm will rarely hang down helplessly. More definite clues are given by the relations to each other assumed by the axes of the forearm and the humerus. The carrying angle is lost or even reversed as the capsular ligament gives way in the fractures of the external condyle and of the internal epicondyle, the internal condyle and the external epicondyle. This fact can be seen readily as with such fractures the arm is in partial extension. Often the same conditions exist with the supracondylar fractures, only it is not so evident as the limb is held in flexion.

The swelling is usually commensurate with the extent of the fracture. The whole elbow is involved in the severe forms, the "Y," "T" and supracondylar; a part, one or the other side with the uncomplicated fracture of the condyle or epicondyle. There is often very little swelling with the fracture of the rotula or the intracapsular fractures. There may be a broken skin or severing of soft parts in the supracondylar fracture by flexion and these complications may be expected when extraordinary force causes the damage, such as falling from great heights, or machine power. In such cases the wrist may drop, there may be lack of sensation in the ulnar region, or even vascular disturbances may occur. Ecchymosis is usually present and may point to the nature of the injury by its presence in one particular side or spot, or involving the whole joint. Abnormal bony prominences may be seen. In the supracondylar fracture by extension the olecranon is pushed out backward, giving the swollen elbow a concavity behind and a convexity in front.

While the external condyle is overprominent in supracondylar fractures, it is almost gone when it has been broken. Normal bony prominences may be missing and depressions noted, as in the fracture of the external condyle and the internal epicondyle. With this latter injury, dislocation is often present. When the rotula is broken, there is usually an abnormally large olecranon, owing to the displacement of the loose shell within the joint near the olecranon.

Conclusive evidence is given by actual manipulation. Active motion is helpful only in a general way. A patient with a dislocation or an extensive fracture will not move his elbow much, while a partial fracture will not greatly hinder him. The effect of a nerve injury cannot escape observation. A valuable sign is the "push pain." With the humerus grasped gently and firmly above the elbow the hand or forearm is given a quick push. The sudden contact of one broken surface with the other elicits a sharp pain. In supracondylar fractures it is difficult to miss, but when the external or internal condyle is broken the forearm is abducted or adducted so that the push will reach these parts. Full normal function in one direction only, and not in the other, usually means dislocation.

Supracondylar fractures, the fracture of the internal condyle and the partial dislocation allow overextension as the capsular ligament is torn in the latter and loose in the former. Free extension is also to be expected in all other forms of fracture except where a loose body interferes, as in the intracapsular fractures or in the "Y" and "T" fractures when some of the fragments are loose in the joint.

Flexion is free except for the swelling of soft parts and hæmarthrosis in all partial fractures, such as those of one or the other condyle or epicondyle. Flexion is rigidly stopped at a right angle in posterior dislocations; it is only partial in the supracondylar or "Y" and "T" fractures. Rotation of the forearm is usually unhindered. Supinations may be too free with the fracture of the external condyle.

Sidewise mobility, abduction and adduction, though slightly present in young arms, is abnormal and gives most valuable evidence. This could not obtain if the capsular ligament

were intact or the bony parts of attachment rigid. In dislocations there are neither lateral nor anteroposterior movements. When the shaft of the humerus is grasped in one hand and the condyle in the other, and there is mobility and crepitation on abduction and adduction, a fracture above the condyle is present; if there is mobility in adduction only, there must be a giving away of the external lateral ligament which occurs in the fractures of the external condyle. Abduction is too free when the internal condyle is broken off, which is usually accompanied by extensive tears of the ligament. In addition, it is possible to elicit crepitation by moving the one or the other condyle or epicondyle against the shaft. Movement of the condyles against each other, and both against the shaft, in all directions may make it feel like a bag of marbles. Such findings prove a complicated fracture like the "Y" and "T" forms.

The exclusion of abnormal mobility does not preclude fracture. The elbow has normal landmarks. In flexion the olecranon and the condyles form a triangular frontal plane; in extension, they form a line. These known points may be disarranged in their relation to one another; one may be more prominent or may have disappeared, or there may be seen new prominences. In the presence of dislocation the olecranon sticks out backward and the triangular plane becomes a concavity; in extension, the olecranon stands above the horizontal line. The normal relation is preserved in the supracondylar fracture but there will appear, anteriorly or posteriorly as the case may be, the sharp prominence of the fracture. Where normally the external condyle should be, there is a depression in which a rough and irregular body moves with the pushed-up head of the radius which could only be the torn-off external condyle drawn down by the external lateral ligament. Only the external epicondyle may be missing. There may be absence of the prominent internal epicondyle with dislocation. Palpation of the internal condyle too far away from the olecranon, and a sharp edge close to it on the humerus, prove a diagnosis of the broken internal condyle. Relation and distance of the landmarks may be correct, only the olecranon feels broadened, the reason being that a loose body lies near the olecranon within the joint, such as the articular surface of the condyles or that of the capitellum. On the other hand, there may be no relation at all with injury to the soft parts, as in the complicated "Y" and "T" fractures.

One other diagnostic measure is important. Simple traction of the forearm will straighten a fracture, but a dislocation remains unchanged. It seems clear that when a painstaking diagnosis has been made a practical means of correction may be found to fit the case. It is thus that the plaster cast has at times been a success in one or the other position. To us, it seems that it should not have a prominent place. The bones in children are thin, and soft parts are well upholstered with fat, so that the tendency to displacement and disaster is great and, indeed, frequent. What means other than surgical will serve to replace a turned-about external condyle or a displaced cap of the rotula? These parts must be removed and the capsule repaired or a stiff elbow will result either from the interference of the broken parts or the growing callus. Whenever mechanical means are feasible, some means of weight extension should be the method of preference, the forearm being in supination and at a right angle to the humerus. In this position all the muscles are equally stretched, the circulation is unhindered and the humerus is kept straight. The "Y" and "T" fractures are usually surgical, though waiting may be necessary because of the condition of the soft parts. Loose fragments must be taken from the cavity of the joint. To prevent excessive callus, the external condyle may be removed and a tolerable joint is expected.

It is not the purpose of this study to enter into the difficult problem of successful treatment. Obviously, the correction of a fracture depends upon a proper diagnosis and, in our opinion, fractures of the elbow should be approached with the same concern as are conditions of the abdomen or the chest.

MESENTERIC VASCULAR OCCLUSION

By ARTHUR A. EISENBERG, A.B., M.D., Cleveland
Resident Pathologist, St. Vincent's Charity Hospital; visiting Pathologist, St. John's Hospital; Demonstrator in Pathology, School of Medicine, Western Reserve University
AND
HENRY A. SCHLINK, A.B., M.D., Cleveland
Resident Surgeon, St. Vincent's Charity Hospital

OUR attention was directed to the extremely interesting surgical condition, mesenteric vascular occlusion, through a rather unusual opportunity to study, within a short space of time — two months — four cases of mesenteric embolism, the entire series making up a very instructive picture of the same condition being brought about by three different causes; acute infection, chronic infection, and injury. Of especial interest is the fact that in these cases we had an opportunity to study the differences in symptomatology and pathological anatomy as related to the duration of the disease.

We purposely substituted the term "mesenteric vascular occlusion" as used by Trotter (1) for the various other names used in describing the several varieties of this condition, viz., "mesenteric embolism," "mesenteric thrombosis," "mesenteric arterial embolism," "mesenteric venous thrombosis," etc.; it seems to us they are useless clinically, since a definite symptomatological picture which would enable one to make a diagnosis of arterial occlusion rather than the venous, does not exist. Even the terms "thrombosis" and "embolism" are of no value clinically, since the most frequent source of thrombosis is an embolus. For these reasons we felt that unless one discussed the subject from the standpoint of pathological anatomy, the term "mesenteric vascular occlusion" would probably be preferable.

The condition, while not an extremely rare one, is nevertheless one of sufficient rarity to be interesting; thus from the time the first case, that of Tiedeman, was reported in 1843 until 1913 there were collected 366 cases (1); since Trotter's monograph has appeared about 35 to 40 more cases have been reported, thus bringing the total to about 400 cases.

Case 1. Male, age 48, machinist, entered the Charity Hospital, May 10, 1917, giving a history of having had a piece of steel in the index finger of the left hand two months previously. From that time his finger remained sore, and about two weeks prior to the patient's admission to the hospital, the entire left hand became swollen and painful; it gradually grew worse; an ascending lymphangitis and lymphadenitis developed; an attempt to establish a good drainage by means of an incision under local anæsthesia was unsuccessful; the day before the admission the left ankle became painful and swollen.

The examination upon the admission revealed a well built man, with temperature of 101.2° and pulse of 120; the infected hand is about twice the normal size, with marked lymphangitis up the entire arm and greatly enlarged axillary glands; the ankle is swollen and red; the patient complains severely of the pain in the hand.

Operation May 10, 1917, by Dr. C. A. Hamann. Ether anæsthesia. Several incisions was made in both palmar and dorsal surfaces of hand. Much pus was obtained. Tube drainage. An incision of the foot revealed no pus. May 13, evening temperature 101°, pulse 108; hand draining freely; patient delirious. May 19, the foot was much more swollen. It was incised under ether anæsthesia; hand draining freely; Dakin's solution applied. June 15, hand and foot improving; not much purulent discharge; evening temperature 99°. June 27, temperature rose to 103°; both hand and foot painful. Roentgenogram of the hand and wrist shows much destruction of the metacarpal and carpal bones, also involving the lower ends of the radius and ulna. June 30, both the hand and foot freely incised; some pus obtained; marked destruction of tendons of the hand. July 2, hand and foot looking better, less swelling; temperature is still about 101. July 6, temperature subnormal; hand and foot progressing fairly well. July 9, 12 o'clock m. patient suddenly seized with severe cramp-like pain in the abdomen; markedly dyspnœic. He soon became very pale and covered with cold perspiration. There was some abdominal distention and generalized tenderness. No definite mass could be felt; no vomiting, no diarrhœa; pulse almost imperceptible; death at 3 p.m., i.e., three hours after the onset.

Diagnosis of mesenteric embolism was made, being based on (1) source of embolism; (2) rapid and marked fall of temperature; (3) very severe colic-like abdominal pain; (4) abdominal distention and generalized tenderness, and (5) suddenness and short duration of attack.

The autopsy (A. A. E.) showed no free fluid in the peritoneal cavity; the omentum was slightly congested; the mesentery was purplish, mottled with thick veins and dark areas; the small intestine was congested, but not extremely so, nor in its entirety: only the lower part of the jejunum and approximately one half (the upper) of the ileum was congested; the congested mesentery corresponded to the part of the intestine involved; there was absolutely no gangrene present; the superior mesenteric artery contained a firm adherent embolus, the size of a large shot, within one-half inch from the aorta; a large thrombus was found in the left ventricle of the heart, firmly adherent to the left posterior wall. Close inspection of the aorta revealed a small patch about one-half square inch, near the opening of the latter which showed that form of atheroma which is referred to in German literature as *gitterformig* (lattice work); however, even though the local changes in the artery wall may have played a predisposing part, this case was, we feel certain, one of embolism rather than of thrombosis, because of the suddenness and the rapid progress of the case; we shall dwell more fully upon this point in the subsequent discussion of the differential diagnosis of the two conditions.

CASE 2. (Dr. A. Peskind.) A complete history could not be obtained for some reason, but the important points in the case are these: the patient, male, about 70 years old, had suffered for a number of years with endocarditis; about two months prior to his death he was taken ill with persistent diarrhœa and some vague abdominal pain; he ran a septic fever; the laboratory examinations performed by one of us (A. A. E.) were as follows: nothing of importance was found in either the urine or the fæces; the blood examination showed a pronounced leucocytosis; blood cultures showed streptococcus viridans; he did not show much change during the next five or six weeks but gradually became better, his temperature became almost normal, when suddenly one night he was seized with violent abdominal pain; he became cyanosed, showing all signs of collapse, and died within six or seven hours after the onset. The diagnosis of mesenteric embolus was made by Dr. A. Peskind. The autopsy (by A. A. E.) showed a large number of old vegetations over the mitral, and, to a lesser degree, aortic valve — one vegetation being as large as a large pea; the omentum and mesenteries were greatly injected and discolored, the small intestine was also congested and discolored for the distance of two or three feet, but there was no gangrene present. The superior mesenteric artery was plugged from the point of its origin to a point about 215 centimeters into its lumen by a thrombus which was quite adherent to the walls of the artery.

CASE 3. (Dr. N. T. B. Nobles.) J. G., male, 17, fell down while trying to step over a box, striking his abdomen on a cement floor; he had a big watch in a pocket which was in a usual place — over the right iliac region. The watch was broken completely by the fall — the crystal as well as the mechanism, but no incised wound was inflicted.

The boy complained of some soreness but kept at work. During the succeeding five days the soreness —it could hardly be then called pain — gradually disappeared. On the sixth day, the patient complained of a moderately severe abdominal pain, but there was no vomiting, and the bowels moved regularly; however, the pain was severe enough to keep him in bed. During the next two days his condition was about the same, but on the following morning, after a light breakfast, he complained of a sudden very severe general abdominal pain, and vomited some greenish material; the family physician was called in and upon examination found the boy in agonizing pain, not localized over any part of the abdomen, a little distention, pulse almost imperceptible, the face and the body covered with cold perspiration, and other signs of collapse. Diagnosis of intussusception was made. The operation performed the same evening, about 9 p.m. showed a large quantity of free blood in the peritoneal cavity, the peritoneum was markedly injected, the intestinal loops were matted together, practically the entire small intestine and its mesentery were gangrenous and collapsed, showing at once that a case was not one of intussusception, but one of mesenteric vascular occlusion. About 8 feet of gangrenous intestine were resected and an end-to-end anastomosis was done. The patient died within half an hour after the operation. No autopsy was permitted.

DISCUSSION

We mentioned elsewhere that the condition is not an extremely rare one; yet, according to Trotter, out of 366 cases collected by him only in 13 was a correct diagnosis made *intra vitam*, or in about 4 per cent of cases. This then must be due to the fact that the mesenteric occlusion is not thought of when considering the differential diagnosis of an acute abdominal condition. We will discuss the general features of our cases together with the general consideration of the subject, but we wish to call attention to several interesting features of these cases.

The first is the relation of the duration of the disease to the pathological changes only.

Case 1, with the shortest duration, showed congestion of both the intestine and the mesentery, but no gangrene; Case 2, with duration of 6 to 7 hours showed necrosis of a larger part of omentum and mesentery but hardly the beginning of gangrene of the intestine, while Case 3, with the longest duration of all, showed extensive gangrene. Case

4 showed complete gangrene of the entire intestinal tract.

It seems then that surgical intervention if it is to be successful must be sought as early as possible, within the first few hours. The other interesting point brought out by the study of these cases is the extreme importance of the history of the case in considering the diagnosis. Thus in both cases where the correct diagnosis was made (Cases 1 and 2) the fact that in both cases a source of embolus was readily conceived (Case 1 — acute pyogenic infection; Case 2 — chronic endocarditis with a concomitant streptococcus viridans infection) was of the greatest assistance in arriving at the correct diagnosis.

In the four cases studied we have two cases due to embolus, with pyogenic infection as its ready source, while the other two cases were, so far as we can judge, due to injury (Cases 3 and 4); in comparing the two sets one is struck with the fact that both infective cases lasted but a short time, since a sudden throwing of an embolus rapidly occluded the circulation while the two injury cases lasted a number of days and showed a marked gangrene formation, probably because these cases had a local thrombosis as their cause (due to injury) which developed much more gradually. Another striking feature is the fact that Case 4 had normal pulse and temperature and had not vomited.

PATHOGENESIS OF MESENTERIC VASCULAR OCCLUSION

1. Mesenteric venous occlusion occurs in about 40 per cent of all cases of mesenteric occlusion. In the majority of cases both the superior and inferior veins are simultaneously involved. Involvement of the inferior vein alone is extremely rare because it forms richer anastomosis with the systemic-venous system relatively to the amount of blood to be carried away than does the superior mesenteric vein, and thus makes possible a more efficient collateral circulation.

In general, venous occlusion is much less dangerous than the arterial,[1] for the reason that the venous intestinal circulation can be carried though a large part of the mesenteric-venous system had been thrombosed — "so long as tributaries which are free from clot open into the main trunk above the highest limit of the clot, and the anastomosing arcades and their radicles leading from the intestine remain patent" (Trotter). Even if the latter are occluded the infarct is frequently limited to the segment corresponding merely with the occluding radicles. In fact, the superior mesenteric vein has been tied near its termination in two cases — (2 and 3). Several cases are recorded in which even the portal vein was ligatured or thrombosed, and the patients either recovered or survived a considerable time — (4, 5, 6, and 7).

The common causes of venous mesenteric occlusion are descending portal thrombosis (usually due to sepsis or pressure due to cicatricial contraction of liver, as in syphilis, cirrhosis, malignant growth, etc.); more rarely (30 per cent of cases) a primary condition due to phlebitis resulting from an infectious process in the intestine (most often appendicitis — 75 per cent of all cases of primary thrombosis) according to Polya (8).

2. Mesenteric arterial occlusions occur in about 60 per cent of all cases of mesenteric occlusions and of this in an overwhelming number of cases it is the superior mesenteric artery that is occluded. When this happens, the damage done to the intestine depends, of course, on the seat of embolus; if the trunk of the vessel is occluded close to its origin from the aorta, then the entire small intestine (with the exception of the middle and upper horizontal portion of the duodenum) and, in addition, the cæcum, the ascending, and the transverse colon, are involved.

We are now confronted with an extremely interesting question; why is there formed following the mesenteric arterial occlusion, a hæmorrhagic infarct? In the light of Cohnheim's well known theory of the genesis of hæmorrhagic infarct, it seems impossible that this should happen in the intestine, since the superior mesenteric artery is not an "end" or "terminal" artery. As Nothnagel (9) points out, the colica sinistra artery originating from the inferior mesenteric artery forms the largest anastomosis in the body

[1] Out of 137 cases of mesenteric venous thrombosis, infarction was found in 91.

with the colica media artery which originates from the superior mesenteric artery, and communicates with the cœliac axis through the gastroduodenal branch of the hepatic artery; all the branches of the superior mesenteric artery can be injected with wax from the aorta through their numerous anastomoses, even after the ligation of the main trunk of the artery.

Nevertheless, Litten's experiments (10) showed that the mesenteric arteries while not terminal anatomically, are so physiologically, probably, as pointed out by Taravellier (11), because the pressure in these arteries is about 80 millimeters mercury, while it takes that of almost 300 millimeters mercury to force the blood through the entire intestinal supply; besides the "anastomosing arcades" are present only in the middle of the territory supplied by the superior mesenteric artery.

The reason the superior mesenteric artery is occluded so much more frequently than the inferior is as follows:

1. The superior mesenteric artery arises from the aorta above the inferior, and has, therefore, an earlier opportunity of intercepting an embolus.

2. The superior mesenteric artery measures 9 millimeters in diameter while the inferior measures only 3.5 to 5 millimeters.

3. The superior mesenteric runs a course nearly parallel to that of the aorta while the inferior leaves the aorta at an angle of about 45 degrees.

Inasmuch as the most frequent cause of thrombosis is an embolus, the autochthonous thrombosis of the mesenteric arteries being extremely rare, it suffices to consider the sources of the embolus to close the consideration of the pathogenesis of mesenteric vascular occlusion. Acute and chronic endocarditides affecting the mitral and aortic valves are by far the most common; the two sources next in frequency, being the atheroma of the aorta and pulmonary emboli — very rare.

Finally 22 cases have been collected where both arteries and veins were occluded (11, 12, and 13).

PATHOLOGICAL ANATOMY

Under pathological anatomy the changes in the mesentery and the intestines are to be considered. As has been mentioned, the extent of changes depends solely on the amount of the damage to the circulation.

In the mesentery the most striking change is œdema which may advance to an extreme degree producing enormous thickening. Œdema may be localized or diffuse: in the case of the former, one may confuse it with mesenteric adenitis; usually, however, it is diffuse, and the first effect of it is the diminished motility of the mesentery — a factor which may *per se* contribute largely in the production of intestinal obstruction.

Blood extravasations are frequently found in the vicinity of the occluded vessels, varying in size from petechiae and small ecchymoses to large hæmatomata palpable through the abdominal wall.

It has been claimed that these hæmorrhages are due to a collateral arterial supply, but, as pointed out by Taravellier (11), were this true, these hæmorrhages would be most marked at the boundaries of the affected areas, whereas in reality they are most pronounced about the obstructed vessels where the compensation is least. With the advance of the occlusion gangrene and necrosis supervene.

The intestinal lesions caused by the occlusion of mesenteric vessels are of two main types, (a) hæmorrhagic infarction, and (b) ischæmic infarction.

Of the two lesions, the hæmorrhagic infarction constitutes the vast majority of cases. It may be brought about by closure of the arteries, the veins, or both. As Gallavardin (14) points out, the venous congestion is by far the most important cause.

The extent of the infarct varies of course from a few necrotic patches to the involvement of the whole small and large intestine.

The condition of the infarcted loop is practically the same as that in a strangulated hernia, since the condition of the vessels is the same: the coil loop is dark red, purple or blue-black, usually is very much thickened because of the filtration of its walls with blood and serum, and is distended from accumulation of gas in the interior. The mobility of the coil is usually seriously impaired or absent.

Microscopically the first changes to be noticed are œdema and leucocytic infiltration, as well as discrete capillary hæmorrhages. The tissues are much thickened because of the inflammatory infiltration.

The next stage is that of engorgement — the capillaries and the vessels are enormously distended.

Now comes the stage of hæmorrhagic infarction proper — extravasation of blood into the intestinal coats, especially pronounced in the submucosa, where it may be so extensive as to separate the mucosa from the muscularis (15). The mucosa shows the most marked necrotic changes, the villi are either completely degenerated or entirely absent, Lieberkuehn's glands are distended and partly necrotic. The muscularis shows fewer changes than any other coat.

The ischæmic infarction still presents one of the most interesting problems of pathological physiology, since nothing but contradictions exist as to its causation. Sprengel (16) claims that it is due to simultaneous obstruction of both the arteries and the veins; yet this is at variance with actual facts since out of 22 cases of double vascular lesions only three showed ischæmic infarction.

The explanation of Fedorwitsch (13) is that it is due to obstructed arterial supply confined with unobstructed venous circulation.

The intestinal wall at the site of the ischæmic infarct is white or grayish, bloodless, and very thin.

SYMPTOMATOLOGY

Because of the various forms in which the disease appears it is impossible to outline a definite course, but there are a few outstanding symptoms which, if properly interpreted, may lead to a correct diagnosis. One feature must again be emphasized, viz., that the symptoms are the same, whether they are due to the arterial or venous occlusion.

Age. The youngest case reported was that of a child of five. The oldest was a woman of 85. But the majority of cases occur between 20 and 60 years of age. Lagane (19) mentions a child one month old.

Pain. The onset of the disease is usually sudden and begins in most cases with severe colic or cramp-like pain in the abdomen lasting for five or ten minutes at a time and passing off for an equal time or it may be continuous. In Case 1 it was continuous throughout the three hours of the attack and was unaffected by morphine. In every one of our cases pain was the earliest symptom. In the majority of cases reported it is generalized throughout the abdomen being usually more intense about the umbilicus or in the epigastrium. The point of maximum intensity may be situated in either hypochondrium or in the lower abdomen. At the present time the origin of the pain is explained as being due to traction on the mesentery and parietal peritoneum from excessive peristalsis, the infarcted coil acting as a source of such peristalsis to the rest of the bowel. If the attack lasts long enough, swelling of the mesentery may also cause traction.

Tenderness. Associated with the pain there is usually extreme tenderness throughout the whole abdomen.

Abdominal distention. Abdominal distention is a constant sign which generally appears very early and increases as the disease advances. It is usually quite general but may be localized. The percussion note is tympanitic except over an occasional area where the intestinal coils may become thickened by œdema and blood extravasation and occasionally in the flanks where the dullness is due to free fluid. Visible peristalsis is extremely rare.

Tumor. Satisfactory palpation of the abdomen is generally rendered difficult by the distention and tenderness both of which may be extreme; also by the reflex muscular rigidity. Consequently in only a few cases has a definite tumor been felt. In some cases a localized resistance can be felt.

Gastro-intestinal symptoms. The gastro-intestinal disturbances may be divided into two groups; viz., (1) those due to irritation in which diarrhœa and melæna preponderated, and (2) those resembling the symptoms and signs of acute intestinal obstruction. Usually when diarrhœa is present the stools are very thin and watery and if blood is present are very offensive. The stools may be only blood-

stained or may consist of almost pure blood which may be bright red or tarry in nature (17).

Defæcation is frequently painful and associated with tenesmus. Constipation may be partial or complete depending on the amount of damage done to the affected coil by the circulatory disturbance, and by the subsequent peritonitis. Borszeky (18) regards neither diarrhœa nor constipation as a constant symptom but attaches importance to the succession of constipation upon diarrhœa. Constipation from the onset of symptoms is rare. Vomiting usually comes on quite early and may persist until death — yet our Cases 1 and 3 did not vomit. At first vomitus consists of gastric contents, later may contain blood which may be either bright red, dark brown or black, "coffee-ground" in type. The last named type should not be mistaken for fæcal vomiting. No case of fæcal vomiting is on record (2).

Pulse, temperature, and respiration. In the early stages in most cases the temperature is subnormal but later may rise to 104° or 105°. Later in the attack when collapse supervenes the temperature again becomes subnormal. The pulse rate is generally that of a severe internal hæmorrhage, small, rapid, and in many cases irregular, as shown very well in Case 1. The respirations soon become accelerated, thoracic in type. The patient's appearance becomes a combination of pallor and cyanosis, the pallor being due to shock and the cyanosis to diminished respiration.

DIAGNOSIS

The two chief factors responsible for the failure in the diagnosis of occlusion in the mesenteric vessels have been: first, the disease has been considered so uncommon that it is not considered in the diagnosis of acute abdominal conditions; and, second, the extreme variation in the clinical picture. The signs and symptoms produced by occlusion of the arteries so closely resemble those due to the venous occlusion that it generally becomes impossible to differentiate clinically between the two conditions. However, as a rule embolism is more easily diagnosticated than any other type of lesion. The signs and symptoms considered of greatest importance in the diagnosis are:

1. Very severe colic-like abdominal pain.
2. Distention of abdomen with tenderness, tympanitis, and occasionally shifting dullness.
3. Rapid and excessive fall of temperature associated with a weak and rapid pulse.
4. Copious melæna with diarrhœa followed by constipation.
5. Persistent vomiting.
6. Palpable tumor due to formation of large hæmatomata between the layers of the mesentery.
7. Appearance of patient manifesting grave constitutional disturbances.
8. Source for the embolus, e.g., endocarditis.
9. Age of patient — usually over 20 years.

DIFFERENTIAL DIAGNOSIS

Intussusception may readily be confused with infarction of the intestine. But intussusception is a disease usually occurring in childhood with a history of previous attacks and complete abatement of symptoms in the interim. On bimanual abdominal and rectal examination a sausage-shaped mass may often be felt. In infarction the amount of blood and fæcal matter should far exceed that passed in intussusception which is blood-stained mucus.

Volvulus. Though the signs and symptoms of the two diseases may be the same, absolute constipation associated with early extreme distention would favor the diagnosis of volvulus; for as stated previously absolute constipation is rare in the early stages of infarction and although the distention may come on early it does not become so extreme.

Pathological complications which may follow an attack of acute appendicitis and give rise to acute intestinal obstruction are almost impossible to differentiate from infarction. The obstruction in those cases is due to toxæmia, peritonitis, adhesions, or infarction of the intestine from thrombosis of the mesenteric veins. The first two complications come on so soon as to be almost a part of the original disease, whereas the latter two may appear after an interval of variable duration. The symptoms following obstruction due to kink-

ing of the intestine from adhesion are usually not nearly as severe and grave as in infarction.

Acute pancreatitis of the fulminating variety (Deaver) is extremely difficult to differentiate. In this disease the temperature may be subnormal, pain and shock severe, and vomiting persistent; intestines become distended and paralytic causing almost complete obstruction. Absence of blood in stools, provided constipation is not absolute, is in favor of acute pancreatitis.

Typhoid fever with perforation particularly of ambulatory form needs to be considered in the differential diagnosis.

TREATMENT

A few cases in which a diagnosis of mesenteric thrombosis was made have recovered under the expectant treatment but in those cases the diagnosis obviously may be questioned. At best the treatment has been unsatisfactory but the prevalent opinion among most observers appears to be that the sooner operative measures are undertaken the better the prognosis, as shown by the absence of gangrene in our first two cases which had lasted not over 5 or 6 hours. In those cases in which all or most of the intestines are gangrenous it is obvious nothing surgically can be done. In this connection Zesas quotes experiments on animals and concludes that in man at least two-thirds of the intestine must be left behind in order to obviate the possibility of death from inanition. If, however, only a small segment of intestine is involved any method of resection and subsequent anastomosis which can be done most rapidly affords the patient the best chances of recovery. In more extensive destruction of intestine and peritonitis drainage must be used.

CONCLUSIONS

1. Mesenteric vascular occlusion is not an extremely rare condition, there now being collected about 400 cases.

2. The occlusion is most frequently in the arteries.

3. By far the most common lesion produced is hæmorrhagic infarction of the intestine.

4. The most common cause of the occlusion is embolism resulting from infection and injury.

5. There is no difference clinically between the arterial and the venous occlusion, regardless as to whether it is due to embolism or thrombosis, in the superior or the inferior vessels.

6. The clinical diagnosis should be made on sudden onset, acute colic-like abdominal pain, distention and tenderness, signs of shock and collapse; often there may be vomiting and constipation; if diarrhœa is present, it is almost always accompanied by melæna.

BIBLIOGRAPHY

1. Trotter. Embolism and Thrombosis of the Mesenteric Vessels. Cambridge: 1913.
2. Wilms. Muenchen. med. Wchnschr., 1901, p. 1277.
3. Robson. Brit. M. J., 1897, ii, 77.
4. Brewer. Am. J. Surg., 1908, i, 619.
5. De Jong. Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1911, xxiv, 160.
6. Sprengel. Centralbl. f. Chir., 1911, No. 2, 33.
7. Jackson, Porter, and Quinby. J. Am. M. Ass., 1904
8. Polya. Deutsche med. Wchnschr., 1905, pp. 257, 299, 344.
9. Nothnagel. Diseases of the Intestines and the Peritoneum, p. 283.
10. Litten. Arch. f. path. Anat., etc., Berl., 1875, lxiii.
11. Taravellier. Obliterations des vaisseou mésentèri ques. Thèse de doct., Lyon, 1910–11.
12. Taylor. Lancet, Lond., 1881, i.
13. Federowitsch. Centralbl. f. Chir., 1911, No. 17.
14. Gallavardin. Gaz. des hôp., 1901.
15. Lagane. Les artérites intestinales. Thèse de doct., Paris, 1911.
16. Sprengel. Arch. f. klin. Chir., 1902, lxvii.
17. Deckart. Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1899, v, No. 3, 511.
18. Borszeky. Beitr. z. klin. Chir., 1901, xxxi, 704.
19. Lagane. Presse méd., 1911, p. 1025.
20. Pedenko. Russk. Vrach, 1913, xii, p. 1780.
21. Britneff. Ibid., p. 1758.
22. Murray. Brit. J. Child. Dis., 1914, li, p. 304.
23. Bornet. Bull. Acad. de méd., Paris, 1912, lxvi, 34.
24. Merkel. Muenchen. med. Wchnschr., 1911, lviii, 2604.
25. Davis. Boston M. & S. J., 1912, clxvi, 130.
26. Delatour. Am. Surg., 1912, lvi, 687.
27. Green. Ibid, lv, p. 458.
28. Leotta. Ann. del. r. 1st. clin. chir., Roma, 1912, iv, 503–552.
29. Thevenot. Arch. gén. de chir., Paris, 1911, vii, 1234.
30. Bolognesi. Arch. f. path. Anat., etc., Berl., 1911, cciii, 213–240.
31. Mathien. Arch. d. mal. de l'app. digest., 1914–15, vii, 610.
32. Rupp. Deutsche med. Wchnschr., 1915, xli, 163.
33. Greaves. Brit. M. J., 1913, ii, 1433.

DISLOCATION OF THE SPLEEN

Report of a Case of Dislocation of the Spleen into the Pelvis and Its Firm Fixation onto the Uterus

By JOHN SALIBA, B.A., M.D., C.M., Elizabeth City, North Carolina
Surgeon, Elizabeth City Hospital

NORMALLY the range of the movement of the spleen is very slight. It moves with the diaphragm with respiration, but not to the same extent as the liver. It is forced downward by a deep respiration. Its upper and anterior border move downward and forward a distance of 1 to 2 inches when the position of the body is changed from the erect or from lying on the back to lie on the right.

Abnormally the range of the movement of the spleen may be so great as to allow it to wander, float, and lie in any part of the abdomen where it may become fixed in its new position. In its wide roving through the abdominal cavity a vagrant spleen is unsurpassed by any other organ. Its excursions into the pelvis are by no means of unfrequent occurrence. When it occupies a pelvic position the spleen may be mistaken for an ovarian or uterine tumor.

Owing to its displacement, the spleen may become considerably engorged. Its pedicle may undergo a gradual or sudden rotation; or twisting which may result early in an engorgement of the organ and later in its atrophy, or may be followed by hæmorrhage, by peritonitis, or by intestinal obstruction.

The effects produced by a wandering spleen on other organs are chiefly mechanical and are due to its dragging or pressure upon them, or to its adhesion to or displacement of them. These factors may act either separately or in combination.

The causes that are responsible for the increased mobility and consequent dislocation of the spleen are: (1) Relaxation of its ligaments. This may be due to a general splanchnoptosis, to an increase in the size and weight of the spleen, or to a laxity of the abdominal walls. (2) Congenital anomaly. (3) Sudden trauma causing rupture of the supporting peritoneal folds. (4)Tight lacing.

In the diagnosis of a dislocated spleen we must rely on two points as our chief guides: first, we must prove the absence of the spleen from its normal position. This is rather a difficult matter, for the anatomical position of the normal spleen cannot be palpated nor can it be ascertained with accuracy by percussion. Ventrally it is sheltered by the ninth, tenth, and eleventh ribs. If felt below the eleventh rib it must be enlarged. The greatest amount of dullness of the spleen is over the tenth and eleventh ribs; above that the lung intervenes between it and the abdominal wall. Further, as the spleen is normally in contact with the cardiac end of the stomach and the splenic flexure of the colon, its position is affected by the condition of fullness or emptiness of these two organs. Dorsally the palpation and percussion of the spleen is also difficult, owing to the proximity of the kidney and to the thickness of the muscles of the back. Second, we must find out if the previous history indicates the presence of a movable tumor which we can recognize as the spleen.

The rational treatment of a dislocated spleen is splenopexy. This is true if the spleen is healthy, but a dislocated spleen is rarely a healthy one and, therefore, splenectomy is often the operation indicated.

REPORT OF CASE

S. G., woman, white, married, age 65, housewife, referred by Dr. W. C. Stevens of Camden, North Carolina, was admitted to hospital on March 6, 1917. Her height was 5 feet and 8 inches and her weight 80 pounds.

She complained of a swelling centrally situated in the lower part of her abdomen, of a feeling of heavy weight in the pelvis, of severe indigestion, of habitual constipation and of painful defæcation.

She had never enjoyed good health and her complaint was of many years' standing. She had suffered from malarial fever. She stated that she had observed the lump in the lower part of her abdomen ever since she can remember and that her mother

told her she was born with it. She was never able to enjoy her food, which consisted entirely of light, soft diet. Her bowels never acted without an aperient. She always had a constant feeling of weight in the pelvis. Her menstruation began at the age of 16. It was of a fortnightly type, lasted five days and was very excessive. She has no dysmenorrhœa and no intermenstrual discharge. Her menstruation ceased at the age of 50. She had two pregnancies. The first at the age of 21, when she was delivered of living female twins; the second two years later when she was delivered of a living male child. Both labors were normal. She had no abortion. She nursed all three children. During lactation her fortnightly menstrual flow did not cease. Her general appearance showed extreme emaciation. Her skin was sallow. She was nervous, irritable and anæmic.

Physical examination. Through the thin flabby abdominal wall there was evident a distinct swelling located in the median line at the lower part of the abdomen and extending upward about three inches from the pubes. It did not move during respiration. On palpation the tumor was felt to be tender when firmly grasped, smooth, firm in consistence, dull on percussion, somewhat triangular in shape, and its base fixed in the pelvis. On bimanual examination, to determine the relation of the tumor mass to the pelvic organs and tissues, the cervix was found to be low down in the pelvis and the os looked downward and forward. The cervix was independent of the tumor. The tumor had no connection with the ovaries and the fallopian tubes. I made out the tumor to be connected with the retroverted uterus and so firmly attached to its fundus that on rocking the uterus from side to side and pushing it up from below the tumor moved with it. No separate mobility of either the uterus or the tumor could be made out. Rectal examination revealed the fundus of the uterus pressing against the anterior wall of the rectum and the presence of hæmorrhoids. She had no urinary disturbances.

Diagnosis. In spite of the patient's statement as to the tenderness she felt when I firmly grasped the tumor and as to her observing the presence of the tumor ever since she can remember, I made the tentative diagnosis of uterine tumor, attributing her statement to an exaggeration due to her highly nervous and irritable condition.

Operation and findings. A low abdominal skin incision three inches in length was made in the middle line extending to the pubes. The peritoneal incision was started high in order to avoid any injury to the bladder. The exposed tumor was found to be the spleen. It was somewhat triangular in shape. Its apex pointed upward; its left side and part of its posterior surface was adherent to the colon; its right side free; and its base thickened and grooved deeply in such a way as to ride astride the fundus of the uterus to the extent of one-half of an inch anteriorly and one-quarter of an inch posteriorly. The spleen which, to all appearances, was normal in structure, had the following dimensions: 13 centimeters at its greatest length, 6 centimeters at its greatest width, which was at the base, and 8 centimeters at its greatest thickness, which was also at the base immediately above its riding upon the fundus of the uterus.

The gastrosplenic omentum and the lienorenal ligament were not elongated as a general visceroptosis was present, and the spleen, the stomach and the kidney were displaced *tout ensemble.* The phrenicocolic ligament was greatly lengthened.

I undertook first to separate cautiously the adhesions between the colon and the spleen with the fingers of my gloved hands, following Rovsing's method. In doing this the capsule of the spleen became detached and a persistent oozing from the raw surface of the spleen took place. To control it I inserted two catgut stitches into the substance of the spleen and watched very carefully to the end of the operation for any hæmorrhage, but none occurred.

The next thing was to decide which one of the following procedures should be carried out: first, splenectomy—to dissect the adhesions to the uterus, tie the pedicle and extirpate the spleen; second, supravaginal hysterectomy and splenectomy — to amputate the uterus through the cervix, tie the pedicle of the spleen, and remove the uterus and spleen together without attempting to separate their firm adhesions; third, hysteropexy and splenopexy — to fix the uterus and the spleen to the abdominal wall; fourth, to close the abdominal incision without any further surgical interference.

Taking into consideration the patient's physical and constitutional condition, neither the first nor the second procedure could be carried out with any hope of a successful issue and, therefore, were contraindicated. I chose the third procedure, as I believed it would not throw any considerable strain upon the patient's system and would give her relief from such symptoms as weakness in the back and painful defæcation.

The suspension was carried out as follows: First, three sutures of No. 4 chromic catgut were passed through the anterior wall of the uterus, 1 centimeter apart, the highest up being placed immediately adjoining the adhesions to the spleen. Second, in spite of the fact that the spleen is a very friable organ and that sever hæmorrhage followed in Greiffenhagen's case where sutures were passed through the parenchyma of the spleen, I was encouraged to adopt Tuffier's method because no hæmorrhage occurred in this case from the insertion of the catgut stitches into the substance of the spleen to control the oozing which followed the separation of its adhesions to the colon. I passed two sutures of No. 4 chromic catgut through the substance of the spleen, 2 centimeters apart; no hæmorrhage followed. Before being tied, the sutures, passing through the uterus and the spleen, were carried through the entire thickness of the abdominal wall with the exception of the skin and the subcutaneous tissue.

The patient left the hospital on March 22, 1917, and although it may be too soon to record the final result, she has reported recently that her symptoms were relieved, that she has gained in weight and strength and that she is able to do household duties.

This case is of interest because—

1. It is, as far as my reading of the literature on the subject extends, the first case on record where the spleen so shaped itself as to ride astride the fundus of the uterus.

2. No hæmorrhage occurred from the spleen when catgut stitches were inserted into its substance, at first, to control the oozing following the separation of the adhesions to the colon, and, secondly, to fix it to the abdominal wall. This might be due to a general increase of the fibrous tissue of the spleen, which could not be verified without a microscopical section.

3. An interesting question might be asked, viz., was the excessive amount and the fortnightly type of the menstruation in this case due to an increased vascularity of the uterus caused by its adhesion to such a highly vascular organ as the spleen?

TWO-STAGE OPERATION FOR CARCINOMA OF THE PREGNANT UTERUS UNDER PARAVERTEBRAL ANÆSTHESIA[1]

By Captain NATHANIEL R. MASON, M.R.C., U.S.A., Boston
Assistant in Obstetrics and Gynecology, Harvard University; First Assistant Visiting Surgeon for Diseases of Women, Boston City Hospital
Assistant Visiting Physician, Boston Lying-in Hospital.

AND

FRANK C. W. KONRAD, M.D., Boston
Former Assistant in Obstetrics, University Frauenklinik, Freiburg i/B; Temporary Assistant to the Surgeons for Diseases of Women, Boston City Hospital

IN the past it has been the custom in the presence of carcinoma of the pregnant uterus, either to deliver the child and extirpate the uterus at the same time, or simply to deliver the child by the abdominal or vaginal route. A fairly extensive review of the literature fails to reveal a single case in which a radical cure was attempted in two operations rather than in one. The purpose of this paper is to raise the question of the advisability of dealing with an operable carcinoma of the pregnant uterus by a cæsarean section, allowing the patient to convalesce, and then at a second laparotomy to perform a hysterectomy. Most writers disregard the life of the baby if the tumor is operable, and the life of the mother if the tumor is inoperable. If, however, we have a viable fœtus and an operable tumor we must consider both the life of the mother and of the child.

The following is a brief review of some of the cases in the literature bearing on the subject:

Green (1) reports a case of a multigravida of 41, at or near term, with a friable growth on the cervix without apparent invasion of the broad ligaments or the vaginal walls. A seven-pound baby was delivered by cæsarean section and an immediate panhysterectomy was done. Drainage was secured through the vagina. The baby lived and was discharged in three weeks. The mother convalesced well until four weeks after operation when she developed an erysipelatous lesion on the buttocks and died about two months after operation of general streptococcæmia.

Lochyer (2) reports four cases, in two of which the carcinoma was discovered postpartum after normal delivery per vaginam. In the third a cæsarean was done but further interference was postponed because of the poor condition of the patient. The child lived, but the mother died a few weeks later from "exhaustion." The fourth case was a sextipara, 32 years old and thirty-six weeks in her pregnancy. A cauliflower growth involving apparently only the anterior lip of the cervix was removed by complete excision of the anterior lip; there was severe bleeding. Six weeks later there was recurrence of the growth on the cervix and an immediate cæsarean section was done followed by a panhysterectomy according to Wertheim. The uterine vessels were clamped before removing the child, which was asphyxiated; it was resuscitated but died 25 hours after delivery. The mother recovered and showed no recurrence after six months. The author favors immediate cæsarean section followed by a panhysterectomy according to Wertheim.

[1] Read before the Obstetrical Society of Boston, October 23, 1917.

Stone (3) reports one case of a deciparous colored woman of 33 in the sixth month of pregnancy. She had had a moderate amount of menorrhagia previous to gestation, then complete suppression for two months followed by irregular bleeding up to the time of treatment. A microscopic examination of a snipping from the cervix revealed carcinoma. A panhysterectomy was done; glands were searched for but none was found. The fœtus was removed from the excised specimen and lived two hours. The mother reported herself well twelve months after operation.

Holdsworth (4) reports one case of a quadripara of 37 in labor. To hasten labor a Champetier de Ribes dilating bag was inserted but failed to have the desired effect. Finally the presenting head was perforated and the fœtus delivered by forceps extraction. A second fœtus presented by the head and was extracted with the forceps; it weighed five and one-half pounds and died two days later. The mother showed no laceration of the cervix. Bleeding was controlled by pituitary extract and she made a good recovery. Twenty days later there was evident extension to the posterior wall of the vagina. Five and ten weeks later showed rapid extension, and much pain at the last consultation.

Herrgott (5) reports a case in a secundipara of 33. Her previous history was suggestive of disease of long standing. In her first pregnancy she miscarried at six months and had leucorrhœa afterward. She was curetted three months after her miscarriage and had temporary relief; this was followed by a leucorrhœa and menorrhagia up to conception. She had two months of amenorrhœa and then began to have bleeding at her regular menstrual time which later became hæmorrhagic in character. At the time she reported she was in labor and the os was dilated to the size of a fifty cent piece. Labor continued with good pains but with little or no progress, and therefore it was decided to do a cæsarean section. The uterus was everitrated, the uterine vessels were clamped, the uterus incised and an asphyxiated male baby of 6 pounds was removed and resuscitated. A complete hysterectomy was then done together with the removal of a portion of the vagina. Thirty-nine days after operation there was no recurrence and the wound had healed completely. Nine months after operation reports seemed to indicate grave recurrence. The author favors the radical operation immediately on recognition of malignant growth.

Palm (6) reports a case of a tertipara in the third month of pregnancy. He did a complete hysterectomy according to Wertheim and discharged his patient relieved after five weeks. There was no later control.

Mylvaganum (7) reports the case of a septipara, a Hindu woman of 40. She had had menorrhagia, metrorrhagia, and a foul discharge for seven months. Examination revealed an ulcerating cervix. This was cauterized and a vaginal hysterectomy was done. A twin pregnancy of approximately three months duration was discovered in the removed specimen after operation. The patient was discharged from the hospital forty days after operation. There was no later control.

Jacobs (8) reports three cases as follows:

1. A tertipara with bleeding in the second month of pregnancy. Vaginal examination showed a friable cauliflower-like growth on the cervix. Immediate operation was advised but was refused. Three weeks later the patient had a hæmorrhage. A complete hysterectomy was done with good immediate results. Eighteen months after operation there was recurrence and the patient died 21 months after operation.

2. A quintipara in her third month of pregnancy showed on vaginal examination a cauliflower-like growth on the cervix. Immediate operation was advised but was refused. Six months later at term the patient had a spontaneous delivery. The baby died shortly after delivery, and the mother several hours later from hæmorrhage.

3. A quadripara in her second month of pregnancy reported with hæmorrhage and jaundice. Vaginal examination showed an ulcerating crater on the cervix. Immediate operation was advised but was refused. Two months later the patient miscarried but retained the placenta. A foul placenta was extracted and the uterus probably ruptured in the procedure. The patient died several days later.

The author's conclusions are: "If the tumor is operable, disregard the pregnancy and do the radical operation at once. If the tumor is inoperable, do only palliative treatment for the mother and save the baby."

There are more cases of carcinoma of the pregnant uterus in the literature, but this review gives a fair idea of the different methods of procedure in this complication. All operators consider carcinoma of the pregnant uterus a grave complication and emphasize the fact that it grows more rapidly during pregnancy, but none seem to recognize a temporary retardation of its growth coincident with the involution of the uterus. The physiological involution of the puerperal uterus is a well known fact, and is it unreasonable to assume that the marked decrease in the vascularity of the pelvic organs following the delivery is accompanied by a delay or a temporary cessation of the growth of the uterine neoplasm? It will also be generally conceded that a panhysterectomy following immediately upon a delivery, whether by the abdominal or vaginal route,

is productive of more shock and loss of blood to the mother than would be produced by a simple cæsarean section. It would, therefore, seem rational to postpone the hysterectomy, if no harm is produced by the delay, until such a time when the patient shall have recovered from the shock of the primary operation. The attempt to eradicate the carcinoma at the time the uterus is emptied presents great difficulties in operative technique on account of the pelvic engorgement. Porro's operation, to be sure, is readily carried out on the flabby uterus which can be drawn up easily out of the pelvis, and the vessels encountered are of such large caliber that their ligation is simple; but the extreme vascularity of the entire pelvis presents an almost insuperable obstacle to a careful and thorough pelvic dissection as is required for the performance of a panhysterectomy for the eradication of malignant disease of the uterus. The condition of the patient at such a time necessitates a more rapid and consequently less perfect operation, thus increasing the chances of recurrence from carcinomatous tissue left behind. The time between the delivery and the hysterectomy should be sufficient only to allow the patient to recover from the shock and loss of blood accompanying the delivery, but should not extend over the period of uterine involution. Thus the patient is in a better physical condition to withstand the shock of a careful operation for the complete extirpation of the uterus accompanied by a complete and thorough dissection of the pelvic glands. Even if a small amount of extension of the carcinomatous growth does occur during this waiting period, it would seem to be more than counterbalanced by the heightened resistance of the patient which would markedly increase the safety and the thoroughness of the second operation.

Another factor in the reduction of shock is paravertebral anæsthesia. Dr. Konrad will tell us later about this anæsthesia and its advantages as compared with other forms of anæsthesia.

My own patient who first interested me in the subject of this paper came under my care at the Boston City Hospital, December 1, 1916.

She had been sent into the hospital two days previously by her family physician. She was twenty-six years of age and had been married for seven years. There had been one child spontaneously delivered seven years before, followed by a normal convalescence. The family history was negative. Her previous health had been good prior to the present illness. Menstruation began at fourteen, occurred every twenty-eight days and lasted five days accompanied by considerable pain in the lower abdominal quadrants. Her last menstruation occurred about seven months before entrance to the hospital. Her present complaint consisted of irregular flowing for three months, and of pain along the inner surface of the left thigh for ten days. Physical examination of the patient at entrance showed a fairly well developed but poorly nourished woman. Her general condition was poor; there was a marked anæmia with a hæmoglobin index of 55 per cent. The abdomen was distended by the pregnant uterus which extended to a point half way between the umbilicus and the ensiform cartilage. Vaginal examination showed a multiparous perineum and an indurated irregularly hypertrophied and congested cervix containing a crater one inch deep which bled easily. No infiltration could be made out in the vaginal roof.

Owing to the extreme anæmia and weakness which the patient showed, it was deemed inadvisable to carry out any radical operative procedure at this time. The vagina was packed firmly with sterile gauze to stop the active bleeding and the packing was changed whenever it became necessary. An attempt was made to improve the general condition of the patient by keeping her in bed in the open air, by forced nourishment, and by the administration of tonics. Under this treatment the general condition became considerably improved and the hæmoglobin content of the blood was raised from 55 to 70 per cent. But as the bleeding could not be controlled by keeping the vagina packed and as septicæmia was to be feared from the continued pack, radical interference seemed urgent.

Sixteen days after entrance to the hospital the patient was prepared for abdominal cæsarean section under paravertebral anæsthesia. In order to meet the exigency of hæmorrhage with transfusion, a male donor whose blood did not agglutinate the patient's blood was on hand.

The anæsthesia included the segments from the eighth dorsal to the third lumbar inclusive and all of the sacral segments, and was preceded by scopolaminenarcophine seminarcosis. The patient received 440 cubic centimeters of a one-half per cent solution of novocaine, the equivalent of 2.2 grams of the drug and adrenalin 1:1000. The cæsarean section required sixteen minutes. At all times the abdominal walls remained completely

relaxed. The patient remained quiet except for slight groaning at the manipulation of the upper angle of the incision.

The small seven and one-half months baby cried immediately on delivery but died six hours later. After the cæsarean section was completed the cervix was cauterized with the Paquelin cautery. At the beginning of the operation the patient had a pulse of 100 per minute; during the anæsthetization and up to the extraction of the fœtus, it rose to 160 per minute and then gradually fell to 104 per minute immediately after the operation. She was removed to bed, took milk and water in the afternoon and passed a comfortable night following the operation without the aid of opiates. On the following day the abdomen was soft and but slightly distended. The temperature was 98.6° and the pulse was 120 per minute. She was given a head rest one hour in the morning and one hour in the afternoon. The appetite was good and there was no vomiting. On the second day after operation she was allowed out of bed. She continued thus to do well up to the sixth day after operation when the temperature rose to 102.8° and the pulse to 130 per minute. A profuse foul vaginal discharge developed but disappeared within a few days. On the tenth day after operation the temperature was again normal and the stitches were removed from the abdominal wound which was well healed. From this time on, however, she continued to run an irregularly elevated temperature, highest in the afternoon and fluctuating between normal and 102.4°. Her general condition, however, seemed to improve. Thirteen days after the delivery the hæmoglobin index had risen to 80 per cent. In the meantime the pathological examination of the specimen removed at the time of the operation revealed epidermoid carcinoma.

Twenty-two days after the first operation the patient was prepared for panhysterectomy under paravertebral anæsthesia. The pulse was 120 per minute and the temperature 101.2° on the morning of operation. A suitable donor for a possible transfusion in case of hæmorrhage was again on hand.

This time the anæsthesia included the segments from the sixth dorsal down through the sacral segments with the exception of the fourth and fifth lumbar segments, and the patient received 2.5 grams of novocaine in 500 cubic centimeters of one-half per cent solution. The laparotomy was preceded by a cauterization of the cervix and inversion of the stump. The uterus and adnexa with as much of the vagina as possible were removed. Some difficulty was encountered in freeing the bladder, but bleeding was moderate. A gauze drain was inserted into the vagina from above to drain the pelvis. During the anæsthetization and cauterization of the cervix, the pulse rose to 168 per minute. At the beginning of the laparotomy the pulse was 142 per minute and then gradually fell during the operation to 118 per minute, rising again to 148 per minute by the end of the operation. The patient was quiet during the entire operation, which lasted two hours and twenty-seven minutes from the beginning of the cauterization of the cervix to the closure of the laparotomy incision.

At seven o'clock that evening the patient, on being questioned, did not remember what had happened from six o'clock in the morning till two o'clock in the afternoon and was not aware of having been removed from the ward. She ran a rather stormy convalescence with the pulse ranging around 120 per minute and the temperature between 98.6° and 102.° The vaginal drain was removed three days after operation and a week later a discharge of urine appeared from the vagina and persisted. The general condition improved slowly. On the eighteenth day after the second operation she was up and about and on the twenty-ninth day she was discharged on her own request. An examination at this time showed a small sinus in the middle of the abdominal wound discharging a thin yellow secretion. The entire pelvis was rather resistant to the examining finger and somewhat nodular on the right.

After leaving the hospital the patient returned to unhygienic home conditions where she began to fail steadily. During the last two months of her life she was in a private hospital under the care of a private physician who reported that there had been a progressive loss of weight and strength accompanied by an irregularly elevated pulse and temperature. There was almost no complaint of pain. She refused nourishment during the last few days of her life, becoming unconscious on the day before her death which occurred four months and eighteen days after the first operation.

It seems fair to consider that the two-stage operation prolonged this patient's life, for it is extremely doubtful that she could have survived a panhysterectomy following directly upon the cæsarean section, or even a spontaneous vaginal delivery. The extent of the malignant growth when the patient was first seen made the ultimate outlook practically hopeless.

The writers raise the hope of a cure for carcinoma of the pregnant uterus by the two-stag operation in such cases in which the disease is detected in the early stages and which permit of a more complete operation than seemed possible in this instance.

PARAVERTEBRAL ANÆSTHESIA

In paravertebral anæsthesia, as the name implies, the anæsthetic is placed outside of the spinal canal about the vertebræ, and in close proximity to the nerve trunks as

they emerge from the spinal canal through the intervertebral foramina. The field of operation is anæsthetized segmentally by blocking each segment separately. This is done along the back by using the ribs in the dorsal and the transverse processes in the cervical and lumbar regions as guides. A needle of appropriate length is introduced vertically over the bony landmark and pushed forward till it meets its resistance. From this fixed and easily located point it is not difficult to find the nerve as it emerges from the spinal canal to pass underneath the inner border of the rib or transverse process. There may be variations in the bony landmarks but the nerves always follow these, so that, guided by them, the needle point can always be brought into close proximity to the nerve, and as this is an infiltration anæsthesia, proximity is all that is desired. For instance, in the dorsal region the needle is introduced on a level with the spinous process about four centimeters from the median line and pushed vertically inward until the point strikes the rib; thus the rib belonging to the process next above is located. Now withdrawing the needle nearly to the skin, the angle is changed so as to let it pass just underneath the rib and the needle pushed one-half to three-quarters of a centimeter deeper. The point of the needle now lies in the intercostal space into which 15 cubic centimeters of a one-half per cent solution of novocaine with 1:1000 adrenalin is injected. This is repeated on both sides until the desired field is anæsthetized.

For the sacral segments a slightly different scheme is followed. Here the nerves do not pass backward but come forward and spread out over the anterior or inner surface of the sacrum. To reach them a needle 15 centimeters long is pushed through the perineum at a point on a level with the tip of the coccyx and 1.5 to 2 centimeters from the median line. The needle is pushed forward parallel to the horizontal and sagittal planes of the body. Thus it invariably meets a resistance at or near the second sacral foramen in the hollow of the sacrum at a distance of about 8 centimeters from the tip of the coccyx. By raising the angle of the needle with each introduction the third, fourth, and fifth segments may be successively located. The injections are made while gradually withdrawing the needle so as to inject in a line over the sacral nerves and infiltrating this entire area.

The first sacral foramen is located by depressing the needle about ten degrees from the horizontal and pushing it forward until it meets a resistance; it should pass about 1.5 to 2 centimeters deeper than for the second foramen.

Because the sacral nerves spread out over the inner surface of the sacrum a larger quantity per segment is injected here than in the dorsal or lumbar regions; namely, 20 cubic centimeters per segment, or 200 cubic centimeters for a complete anæsthesia of all the sacral segments.

Preceding the anæsthesia patients are given 10 grains of veronal on the night before operation; one two-hundredth of a grain of scopolamine and one-half of a grain of narcophin two and one-quarter and one and one-half hours respectively before operation. In patients that are cachectic or weigh under one hundred pounds three fourths of this dose is given. If necessary to keep the patient absolutely unconscious, one-half of the above dose may be repeated at no less than one and one-half hour intervals. This preliminary seminarcosis is necessary to eliminate the psychic shock and phlegmatic patients will need less of this, particularly if the anæsthesia is perfect. In fact, if she so desires, a patient may remain fully conscious during the operation; the injections are less painful than it would seem. However, I give it as a routine.

The only general reaction that I have observed outside of the anæsthesia is a slight temporary pallor due to the adrenalin, and a temporary rise of the pulse which I attribute to the amount of fluid injected. The blood pressure is not noticeably affected.

The anæsthesia continues from 2 to 4 hours and then fades out gradually. Occasionally lip and throat dryness from the scopolamine becomes annoying but this can be counteracted by sips of water, even during the operation, for patients rarely

vomit, and if so, from other causes than the anæsthesia. Shock is practically eliminated by this combination.

ABSTRACT OF DISCUSSION

DR. E. B. YOUNG, Boston: As Dr. Mason has mentioned, at the time the patient was first seen I thought that her physical condition was such as to make any radical interference extremely precarious. The disease appeared to me to have extended too far into the parametrium, and we know that in pregnancy and immediately after confinement malignant disease spreads very rapidly

DR. HENRY T. HUTCHINS, Boston: Dr. Mason kindly asked me to see this patient. The case at the time seemed to be inoperable as far as a permanent cure was concerned. It did seem advisable, however, for something to be done to relieve the bleeding and discharge. The patient was anæmic, frail, and gave one the impression that the loss of weight and the weakened condition were due to the invasion of malignant growth rather than to the loss of blood which the patient had sustained. It is to be regretted that after the painstaking care which Dr. Mason used in every detail that the patient could not have been relieved for a longer period, if not finally completely cured.

DR. STEPHEN RUSHMORE, Boston. My experience with carcinoma of the cervix and pregnancy is limited to two cases. One of these was seen very early on account of bleeding, and I was so much interested in the carcinoma that I overlooked the pregnancy. When I saw the patient a month later and told her she was probably pregnant in the third month, she regarded my first diagnosis as an error and I have never seen her since. I am told now, several months after the birth of her child, that she is in "very poor health" but I have not been able to get her to come to see me nor send me any word about herself.

The second case I operated on in the fifth month of pregnancy, removing the whole uterus with tubes and ovaries. This patient lives outside of Boston and I have not seen her since she left the hospital sixteen months ago. Her physician told me recently, however, that she is apparently in excellent health.

The principles formulated by Dr. Mason seem sound, and if, at the cæsarean section the internal iliac arteries are tied, involution would probably be much more rapid and more complete at the time of the hysterectomy.

REFERENCES

1. GREEN. Case Histories in Diseases of Women, pp. 237 and 238. Boston: W. M. Leonard, 1915.
2. LOCHYER. Brit. M. J., 1909, ii, 1044–1046.
3. STONE. Am. J. Obst., N. Y., 1908, lviii, 993–995.
4. HOLDSWORTH. Brit. M. J., 1915, p. 1084.
5. HERRGOTT. Ann. de gynéc. et d'obst., Par., 1908, ii, 651–656.
6. PALM. Ztschr. f. Geburtsh. u. Gynaek., Stuttg., 1912, lxxii, p. 762.
7. MYLVAGANUM. Lancet, Lond., 1913, ii, p. 930.
8. JACOBS. Monatschr. f. Geburtsh. u. Gynaek., Berl., 1912, xxxvi, 34–39.

DEPARTMENT OF TECHNIQUE

FORMALDEHYDE–PHENOL IN CAMPHOR PARAFFIN

A New Wound Antiseptic

By KARL CONNELL, M.D., New York

THE combination herein described was the result of a laboratory survey by new methods of the various clinically useful antiseptics. A preliminary trial of this antiseptic in the traumatic crushed wound of civil surgery at the Roosevelt Hospital, New York, has demonstrated that it is a powerful and efficient combination of time tried antiseptics. It combines the rapid sterilizing action of formaldehyde with the slow embalming action of phenol. The painful properties of the former antiseptic and the local and general toxicity of the latter agent are mitigated by dissolving them in an anhydrous, slowly spilling reservoir, namely, the camphor paraffin solvent.

The purpose of this combination was to produce an antiseptic of high efficiency and lowered toxicity, which, when employed as the first major surgical dressing together with efficient drainage in the surgery of the advance dressing station, may possess such power of diffusion through organic matter and such permanency of bacterial inhibition that the crushed infected tissue of the war wounds may reach the service of the rear, well drained, without extending infection or local putrefaction.

In working out the relative merits of various proprietary antiseptics for the Research Committee of the Medical Section of the Council of National Defense, it soon became evident that new laboratory methods must be devised in order to gauge rapidly the wound efficiency of antiseptics. The writer has been chiefly interested in the problems of the Surgery of the Advance. In this zone, often times because of military exigencies as in time of intense activity and in open campaign, the wounded cannot be redressed for days at a time. The ideal antiseptic agent for this zone should, therefore, possess, together with a rapid surface sterilizant action, also a wide penetration through blood-clot and crushed tissue, and an embalming action continuing for at least four days, together with the physical properties of remaining in the wound and not blocking drainage. Although the determination of the phenol coefficient gives a rough index of the antiseptic value of a given chemical, yet it is not applicable to oily and solid substances nor does it simulate the conditions under which the antiseptic must remain efficient in the average wound.

To sort out those antiseptics which, in addition to antiseptic action as determined by the phenol coefficient tests, also possess some power of diffusion through organic matter, and which retain antiseptic virtue in the presence of organic material, a series of tests were devised by the writer collaborating with Dr. William Elser, Professor of Bacteriology, Cornell Medical School.

These tests were designed to gauge the antiseptic diffusion distance under various conditions approximating those existing in the wound.

Summary of study. On to a 5 centimeter column of solid agar, thinly seeded with staphylococcus aureus, 2.5 centimeters of the antiseptic was superimposed. The tube was then incubated, and in 20 hours a good growth of discreet colonies became visible in the agar, except where in a certain zone of agar directly beneath the layer of antiseptic no bacterial growth had occurred. The measurement of the thickness of this clear zone yielded a basis of comparison between the various antiseptics. Carefully measuring in millimeters the depth of antiseptic penetration thus demonstrated, and comparing the square of this measurement to that obtaining in a control tube employing a 5 per cent solution of phenol in liquid petrolatum as the comparative agent, a proportion is yielded which the writer has termed the Elser phenol coefficient of antiseptic diffusion. With 5 per cent phenol, this zone of inhibition usually measures 15 millimeters in thickness, varying slightly with various batches of culture media and strains of bacteria. Yet as compared to the usual phenol coefficient deter-

mination, this diffusion coefficient is remarkably constant, and the test gives a graphic picture of the effective penetration of an antiseptic into solid media of low organic content.

The method seemed useful in that it rapidly sorted out those antiseptics known to be of clinical value and branded others of doubtful repute as feeble or inert, and furnished a new standard of comparison. The method was therefore developed further, employing ascitic agar and finally fresh human blood, clotted in blankets of the desired thickness on the agar column, as the organic medium through which the antiseptic must diffuse. On to this the antiseptic was pipetted and the depth of 20 hours inhibition gave a clear idea of the penetrating power of a given antiseptic through blood-clot, sufficient to inhibit bacterial development. As a further test in another set of tubes the antiseptic was mixed with varying proportions of blood, liver, and muscle pulp for varying periods of time and then superimposed on the agar tubes, illuminating certain questions as to the action of antiseptics in the presence of organic material.

The method is described in a forthcoming article in the *Journal of Bacteriology*. Only a rough summary is given below of the work which furnished a basis for the formulation of antiseptic herein described.

These tests extended over three months in the Laboratory of Bacteriology, Cornell Medical School, by Dr. William Elser and Dr. Frank Huntoon, and at the Harriman Laboratory of the Roosevelt Hospital, by Florence Hulton Frankel, Ph.D. They were incomplete and of necessity hastened by war emergency yet they yielded the following information:

a. Heavy metal group. Mercury is the only metal which possesses as an element or in combination as a salt any substantial power of diffusion to act as an antiseptic. All salts of mercury, soluble and insoluble, possess the power of diffusion through solid menstruum of low organic content. Of the mercury compounds, mercurophen diffuses the most widely. However, all mercury salts in clinical strength possess little power of penetration through blood-clot and become bound and ineffective when mixed with crushed tissue. Metallic mercury itself exercises a remarkable power of diffusion, inhibiting and sterilizing for a zone of at least 5 millimeters in all directions. (Elser diffusion coefficient 11:100.) In ointment even in dilution as low as 1 per cent of metallic mercury it maintains this power of diffusion. Thus mercury ointment inert by ordinary methods, studied by this method justifies the clinical confidence that is generally placed in it.

b. Halogens. Iodine in itself has limited power of diffusion. It diffuses best from solution in paraffin oil. In the tincture, the diffusion distance is much less than that of the alcohol in which it is dissolved. Iodine possesses practically no power to penetrate blood-clot and belongs in the class of perishable antiseptics of utility in the presence of organic matter only when supplied in heavy dosage.

Chlorine. In clinically employed percentage chlorine diffuses more widely than solid or saturated iodine. Like iodine it possesses no power to penetrate blood-clot except when present in caustic dosage or in with free alkali. It is not an embalming agent but belongs in the group of perishable surface antiseptics. When it is entirely combined with organic matter such material becomes an improved culture medium for bacteria. Chlorine, therefore, to be clinically useful must be frequently renewed as by the Dakin-Carrel method, or continuously supplied from a capacious chemic reservoir, as from dichloramin oil.

The other oxidizing substances are so feeble as scarcely to deserve mention.

c. Aromatic series. To this series belong the only antiseptics possessing power of wide diffusion through organic matter together with lasting embalming action in such dosage as may be employed without intoxication. Many of the aromatic oils possess mild power of antiseptic diffusion, eucalyptol being a prominent example (coefficient 16:100).

The dye stuffs (flavine, etc.) justified no confidence. In fact the only remarkable antiseptics were the time tried phenol and formaldehyde. Of the phenol group, phenol itself manifests the highest efficiency, surpassing the cresols, the saponified phenols and saponified cresols and other antiseptics. It diffuses equally widely from oil (paraffin) as from water, it is but little inhibited by the presence of excess of organic matter, penetrates blood-clot widely and acts as a permanent preservative or embalming agent.

From a diffusion standpoint the most potent antiseptic of all is formaldehyde. This possesses an agar diffusion coefficient unapproached by that of any other antiseptic (1 per cent aqueous solution = 1,400:100), together with a remarkable penetration of blood-clot (320:100). Formaldehyde falls short of phenol only in the permanency of its antiseptic action. Formaldehyde in such concentration as can be employed clinically loses the larger part of its antiseptic

properties in twenty-four hours when in contact with organic matter.

In combining the known clinical with the experimental data on antiseptics, it seems probable that the choice of antiseptic for repeated application must fall in the perishable iodine chlorine group; and that the choice for permanency of single first dressing must fall in the phenol and formaldehyde group. It is improbable that any one antiseptic or compound can accomplish all desired results.

Iodine seems clinically available, slowly yielded from a chemic reservoir such as hexamethylenamin-tetraiodid (80 per cent available iodine) or from a physical reservoir such as a saturated solution in paraffin oil (0.8 per cent available iodine).

Chlorine seems at present available from an aqueous source frequently renewed as the Dakin hypochlorite solution or monochloramin, or from hexamethylenamin-tetrachloride, or better from a more capacious and lasting anhydrous reservoir such as dichloramin in eucalyptol.

For the first sterilizant and embalming action on fresh wounds in the surgery of the advance dressing stations, probably the only efficient antiseptics are in the aromatic series. Balsam of Peru and eucalyptol represent the mild types, phenol and formaldehyde the powerful and toxic types. A combination of these two latter antiseptics present so many points of advantage over the dichloramin in eucalyptol for the first application, that such combination aawited only some way to control the toxicity to establish clinical superiority.

As to control of toxicity, long experience with the solutions of phenol in camphor, both in civil and in war surgery, has demonstrated that this solvent eliminates in large measure the dangers of phenol poisoning. Phenol diffuses so slowly from solution in camphor that a large reservoir of phenol may be supplied (30 per cent or more of phenol in 70 per cent or less of camphor) from which the phenol flows slowly as a wound embalming agent without the local caustic action and the dangerously rapid absorption that has placed aqueous phenol in disrepute. The diffusion from camphor (30 per cent of phenol) is less than half in total amount that diffusing from equal volumes of 5 per cent aqueous solution. (Ratio: diffusion 12 times greater from water than from camphor.)

The toxicity of formaldehyde is largely local. Formaldehyde has long been employed in traumatic surgery as a powerful local disinfectant, but it is extremely painful and the use of aqueous solution stronger than 1:1000 causes many hours of suffering. From glycerine the formaldehyde diffuses less rapidly and glycerine as a solvent somewhat mitigates the pain and allows clinical usage up to 1 per cent, but glycerine, like water solution, is too evanescent and becomes washed from the wound. In an endeavor to lower the diffusion coefficient and stabilize a large body of formaldehyde, I passed this gas into camphor-phenol and found that it readily entered into solution up to 0.5 per cent and that by the addition of alcohol to the camphor-phenol, as in the Chlumsky formula, 2 per cent or more of formaldehyde could be dissolved. Clinical trial of this solution on fresh wounds at the Roosevelt Hospital, New York, demonstrated that the formaldehyde thus dissolved in camphor-phenol no longer caused agonizing pain. Even in strengths up to 1 per cent it caused only transitory smarting, probably mitigated on account of the slow diffusion of the formaldehyde from the anhydrous solvent and because of the anæsthetizing property of the phenol-camphor. The Elser diffusion cœfficient of phenol 30 per cent in camphor was raised by the addition of 1 per cent of formaldehyde from 66:100 to 445:100.

Thus a wound antiseptic combination of high efficiency seemed available. Clinical tests of this combination on lacerated wounds at the Roosevelt Hospital New York, justified the theoretical confidence. The soiled and crushed wounds of civil surgery healed promptly without evidence of infection or chemic trauma, indeed much better than with tincture of iodine, and slightly better than with dichloramin in eucalyptol. However, repeated application to open wounds showed distinct evidence of chemic insult to the tissue. The preparation is, therefore, too powerful and permanent in its antiseptic action for use as redressings after the normal wound barriers are established. In this latter field this combination in nowise competes with the halogen antiseptics.

The next problem was to improve the physical character of the antiseptic, whereby, first, the formaldehyde would be prevented from evaporating out, and second, whereby the antiseptic would be held more permanently in the wound, and third to supply advantageous drainage properties to the antiseptic.

As to the necessity of these improvements, I found that on exposing the liquid solution in a watch glass at 36.5° C., the formaldehyde largely evaporated out in 24 hours but that on solidifying the combination by the addition of 10 per cent of hard paraffin the formaldehyde was held. Second, it has been my experience with camphor-

phenol in war surgery that in the Chlumsky formula, it washes too freely from the wound by the end of 24 hours. To check this, I had employed paraffin oil as a dilutant after the formula of a proprietary phenol-camphor and found it effective. Third, in experimenting in connection with an improved first aid packet as to what grease was the best on gauze to prevent gauze from sticking in a wound, and to maintain drainage, I found that paraffin was superior to vaseline and much superior to liquid oil. Therefore, to obtain these accumulated advantages, paraffin was added to the camphor-phenol formaldehyde in such amount as to render it solid at all ordinary temperatures but a liquid system for diffusion at body temperature. Beginning with 9 per cent of hard paraffin I tried out a series of mixtures up to 50 per cent of paraffin and found that the qualitative properties of the antiseptic was not diminished by this dilution. The answer no doubt is found in that the paraffin holds little of the phenol and formaldehyde compared to the camphor and the two systems are thrown apart on shaking in a small percentage of water. The ultimate product, therefore, to obtain the highest advantage physically and as an antiseptic was compounded as follows:

A. To 70 parts by weight of pulverized camphor add 30 parts of phenol, liquefied by heat. A clear solution results.

B. Next melt together paraffin of 52° C., melting point about 3 parts, and paraffin oil 9 parts adjusting the proportions until the mixture frosts on the bulb of a test thermometer at 40° C.

Add 45 parts of *A* to 50 parts of *B*. Obtain a solution freezing at 35° C.

C. Prepare 10 per cent of formaldehyde in alcohol. Most readily accomplished by adding formalin to alcohol and dehydrating by desiccated sodium sulphate. To 9 parts of *A B* at 40° C. slowly add 5 parts of *C*. A clear solution of all ingredients results which freezes and melts at 36° C.

Store in open mouth bottles with paraffined corks or pour directly onto tightly wadded gauze packing for ultimate comsumption.

Indications for use of formaldehyde-phenol in camphor paraffin. This preparation is to be used as the first major wound antiseptic in civil surgery and in the surgery of the advance dressing stations. It sterilizes and embalms crushed devitalized wounds for transportation or for long immobilization without redressing.

Method of application. Free surgical drainage should be established. Gauze saturated with the antiseptic should be applied as packing into all clefts and pockets. The interior of the wound should be packed firmly, but the drainage openings should be packed loosely. It should be spread as a sheet on all open wounds and covered with paraffined gauze. (On wounds for primary suture, it should be employed as is tincture of iodine.)

a. Antiseptic properties. Phenol and formaldehyde are the only antiseptics possessing power to penetrate blood-clot. In the present combination the toxic properties are within reasonable limits. This combination for subsequent dressings is not as advantageous as the chlorine antiseptics.

b. Clinical properties. The powerful penetrating effect of formaldehyde is retained, but severe pain as with aqueous solution is mitigated by solution in phenol-camphor.

The long continued slow embalming anæsthetic action of phenol is retained and that undesirable local toxicity and general absorption of this agent is rendered negligible by solution in an anhydrous favorable menstruum.

The anæsthetic effect of the phenol is supplemented by the camphor together with the clean odor and fly repellent properties.

c. Drainage properties. The paraffin prevents the blocking of the discharge and allows easy removal of the packing.

d. Physical properties. It freezes and melts at 36° C. It stays well in a wound and remains antiseptic in contact with tissue for many days.

e. Toxicity. Two ounces by subcutaneous injection is within the lethal limits. Preferably not more than this amount should be employed at any one first dressing.

FORMULA

By Weight	Per Cent
Formaldehyde	.5
Phenol	13.5
Camphor	31.5
Alcohol	4.5
Paraffin 52° C	
Paraffin oil	50

ESSENTIAL POINTS IN THE METHOD OF HERNIA OPERATION[1]

By A. BELCHAM KEYES, M.D., F.A.C.S., Chicago
Surgeon Cook County Hospital; Captain M.R.C.; Surgeon Advisory Board 3C, Chicago.

THE very large number of draft army "incapacitates" from recurrent inguinal hernias and after abdominal operations, often in clean cases but especially if drained, prompts me to reiterate some of the common essentials in the methods of performing hernia operations and closing abdominal incisions which I have found withstand best the violent, sudden increases of intra-abdominal pressure to which men in the army and navy are subjected.

INGUINAL HERNIA OPERATION

The four-inch inguinal hernia incision between the anterior superior spine and the pubis, through the skin and the superficial and deep superficial fasciæ should be as bloodless as possible, for the better appreciation of each separate anatomic layer.

Pass the director obliquely into the inner angle of the external ring.

Divide the external oblique fascia from the inner angle obliquely upward and outward, leaving as wide a lower external oblique flap as possible.

Pass the finger under the upper flap of external oblique and expose the tendinous portion of the internal oblique.

Pass the finger under the lower flap of the external oblique baring and following along Poupart's ligament to its pubic attachment.

Lift the spermatic cord. *In oblique inguinal hernia*, inspect the spermatic cord—in sheath—carefully. The edge of the white hernia sac can often be seen.

Tear through the cord sheath only near the white sac edge, seize it, and wipe cord downward entirely off from "hernia sac;" open the sac apically, slit down the whole length, pull up strongly, and free the sac base to the parietal peritoneum level, transfix the emptied sac low and tie and excise (if a sliding hernia exists, suture the sac opening at the parietal peritoneum level, avoiding injury to the sliding viscus or its circulation. (*In the low neckless direct inguinal hernia*, beware of the bladder; open the sac between the forceps as in a laparotomy as high up as possible, avoiding deep epigastric vessels.)

Loosen cord well at upper angle to allow of a longer new inguinal canal floor.

Insert interrupted sutures from the higher upper cord angle (*under the cord*) coapting entirely the *tendinous* part of the internal oblique and conjoined tendon to Poupart's ligament. (Three or 4 mattress sutures one-half inch apart suffice.) (Poupart's should be exposed by the left index finger hooked over the lower—external oblique—flap and never dragged on by forceps which will injure and tear important fascia, but will not expose the real Poupart's ligament but only an edge three-eighths inch above it). Do not tie now.

Sutures external to the cord at Fergusson's angle are also often necessary.

Draw all the cord floor sutures *surgically* tight at one time, so that the tendinous part of the interior oblique and conjoined tendon coapt with Poupart's ligament throughout; hold so coapted, then tie separately clench knots, not grannies.

Now place the cord down on its new floor.

The external oblique upper flap is now brought down covering the cord, and the edge sutured in its entire length, interruptedly, as near to Poupart's ligament as possible.

The external oblique lower flap is now laid over the upper flap and its edge sutured interruptedly along the upper margin above the spermatic cord ridge line, or higher to make a fairly tight imbrication.

Close the skin incision with clips or silkworm sutures. A "hay band" silkworm drain, to be removed on the fourth day, should be placed between the deep superficial and external oblique fasciæ. (Good chromicized, No. 3 or larger catgut or kangaroo tendon should be used for deep sutures.)

The above method carefully carried out on a field kept "bloodless" by the double application and division between forceps of all blood-vessels, the thorough drawing up and thorough freeing of the sac to its very base, and tying low, the thorough loosening of the cord at its upper angle and beginning the first internal oblique Poupart's ligament suture high up, and the others at regular intervals making a longer floor for the cord canal, the drawing of all of these floor sutures surgically tight at one time before tying, thus avoiding poor coaptation (which with the perfect clench knot are very necessary

[1] Publication approved by direction of the Surgeon-General, United States Army.

to insure a successful operation), also the interrupted suturing of the upper external oblique flap, the edge of which if sutured down as near to Poupart's ligament as possible acts as a support to the internal oblique Poupart's sutures and allows of a better imbrication by the lower flap over it, making a strong double layer of external oblique fascia above the cord.

The Wood-McEwen-Bassini-Marcey methods of doing hernia operations have very unfortunately so often been subjected to very unscientific changes, some of them devoid of anatomic justification, such as insufficient freeing and low tying of sac base, or not lifting the cord, thereby inviting a recurrent direct hernia, or suturing the weak red friable internal oblique muscle to Poupart's to form the floor, or edge-to-edge slack "kissing-co-aptation" suture of the two external oblique flaps, or placing the cord between the two imbricated external oblique layers, thereby rendering the imbrication useless, have all aided in bringing about the incapacitation of too many of the young men otherwise physically fit for army service.

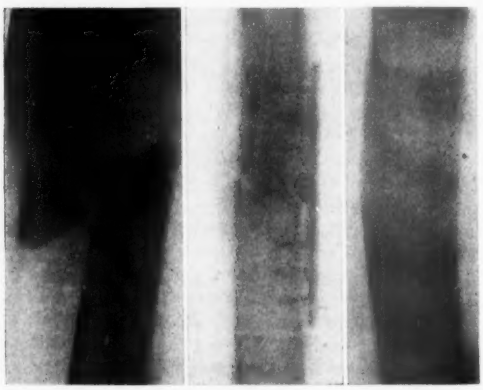
IN LAPAROTOMIES

In all umbilical and ventral hernias and closure after laparotomies where no hernia previously existed, sutures by stages "like to like" with imbrication of the fascia, give a very much firmer wound closure. In all drained laparotomy cases, imbrication is a necessity if hernia is to be avoided — the drain being preferably placed at the middle of the wound where the imbrication is widest, and never at the end where the imbrication is least.

END-RESULT WITH A BONE PLATE ON A FRACTURED FEMUR

By CARL G. SWENSON, M.D., F.A.C.S., Chicago
Attending Surgeon, Passavant Hospital

A boy, age 13, was injured in an automobile accident. He was admitted to the Passavant Hospital, September 18, 1914. Examination revealed a fracture at the central part of the right femur. September 19,



a roentgenogram was taken of the fractured bone. This picture showed a complete lateral separation of the fractured ends. September 22, four days after the accident, the boy was anæsthetized and the fractured bone was reduced. Adhesive plaster and extension was applied to the leg. Another roentgenogram taken September 28, of the fracture showed that the fractured bone was not in good apposition. October 1, twelve days after the injury, I did an open operation on the fractured femur and found the muscular tissues impacted between the bone ends. These soft tissues were removed, the fractured bone was reduced, and an animal bone plate, fastened by bone screws, was applied. Then a plaster-of-Paris cast was applied to the whole extremity. On October 29, twenty-nine days after the operation, the cast was removed and the stitches taken out. There was primary healing of the incision. A new cast was applied and kept on the leg two weeks, when it was removed, November 12. On November 5, thirty-six days after the operation, the patient began to sit up in a chair. On November 23, fifty-four days after the operation, the patient commenced to walk around on crutches. From November 30, massage was applied to the patient's knee every second day for three weeks. The patient left the hospital December 3, 1914, having been in the hospital ten weeks. On December 2, 1914, a roentgenogram was taken which shows the applied plate to the fracture. Two years and six months were required for the absorption of the bone plate. It is probably the first case reported on absorption. The last roentgenogram taken in March, 1917, shows absorption of the bone plate.

The animal bone plates and screws used in this case were devised by Dr. E. J. Brougham and A. C. Ecke, and they have reported good results in 31 cases at the Passavant Hospital.

Fig. 1 (at left). Before reduction.
Fig. 2. Brougham and Ecke bone plate applied.
Fig. 3. Bone plate absorbed.

CONCLUSION

Bone plates are preferable to metallic plates for two reasons: (1) absorption takes plates with bone plate and screws; (2) bone plates retard ostengenesis less than metallic plates. Furthermore as bone plates are absorbable removal would be necessary in less cases than if metallic plates were used.

CEREBRAL HERNIA

A Method for its Surgical Treatment

By ARNOLD SCHWYZER, M.D., F.A.C.S., St. Paul, Minnesota

DURING the present war there has been a large number of injuries of the head, and our medical journals have given us numerous accounts of them. For instance, in the May, 1917, number of International Abstract of Surgery, there is an article giving the experience of Sargeant and Holmes with the late results of gunshot wounds of the head, as they observed them in the London hospitals. After excluding from 1239 cases of head injury the superficial ones and the recent and uncertain cases, there remained 610 patients with serious injuries. Of 26 cases, from whom the missile had been removed by operation, 6 developed hernia cerebri, with 2 deaths. Out of 69 cases with the missiles *in situ* 14 developed brain hernia with 2 deaths. In the 68 cases of through-and-through shots 14 developed cerebral hernia. Four out of the 14 died. Out of 310 cases of penetrating wounds without retained missile 86 reached England with cerebral hernia. Nineteen of these died, and in 18 other ones the wounds were not yet healed at the time of the report. Thus among the 610 cases of severe forms of cranial injury these two authors alone observed the formidable number of 120 cases of cerebral hernia. I shall not attempt to go further through the literature. I simply picked out the above observation as an example.

Probably the large percentage of infection in the wounds in the present war is an important causative factor in a great number of the cerebral hernias. The protrusion is probably due to an œdema of the brain substance caused by the infection.

While brain hernia due to cranial defects without an open wound may be repaired in many ways, as by free transplantation of bone or other material, or as we have done, for instance, with a large defect in a young child, by pedunculated flaps of pericranium combined with free bone transplantation, our difficulties in brain hernias in the presence of infection and loss of the covering skin and soft material, are greater.

For this reason I feel induced to publish a procedure which we employed in one instance and in which a plastic closure of the cerebral hernia at the top of the cranium not only apparently differed from that generally used, but also gave a very satisfactory result. A report of the case in which this procedure was used follows:

On October 7, 1910, Doctor Gendron of River Falls Wisconsin, kindly referred to me a patient about 30 years old, who, on September 23, while in a silo, had been injured by a galvanized iron pipe which weighed 25 pounds falling on his head from a height of 30 feet. It struck him with the sharp edge on the posterior portion of the midline between the parietal bones, and it cut into the brain substance to a depth of an inch or so. Dr. Gendron reached the patient, who was unconscious, 45 minutes after the accident. About 2 tablespoonfuls of brain substance had oozed out. The hæmorrhage, though, of course, the longitudinal sinus had been divided, was not alarming. The wound was 5 to 6 inches long. The inner plate was much splintered and bent down. In prying the bones apart to remove the splinters, a sudden deluge of blood came from what the doctor judged to be the longitudinal sinus. The hæmorrhage, though fearful, was soon checked by iodoform gauze and finger pressure. Then some more loose pieces were removed and the wound was packed tight with iodoform gauze, which was held firmly in place by sewing the skin over it. This gauze was later on gradually removed, the last of it eleven days after the injury. There was no rise in temperature at any time beyond 99⅕°; the pulse was about 88 or 90. The patient was very dazed. The eyesight at first seemed gone, but gradually returned. The appetite was good and the wound looked good. However, since the packing was removed, a cerebral hernia started, for which the patient was referred to me on October seventh, i.e., two weeks after the injury.

The general condition of the patient, apart from a certain dullness, was quite good. The examination of the eyes showed no restriction of the field of vision on the right side, while an object approached from the left was not differentiated until practically the axis of the eye was reached. This homonymous hemianopsia meant in our case, of course, an injury to the cortical field of vision or its optic radiation fibers in the right occipital lobe.

The wound had been kept clean and looked good. The extent of the brain hernia can best be judged from the sketches, which were exact in size and proportion, though the whole wound was a little farther back on the cranium than shown in the pictures. The wound was about 5 to 6 inches long. The width of the bony gap in the center was a little over one inch.

That portion of the protruded brain substance which lay outside of the inner level of the bone, we now removed. The outer parts of the removed brain substance were shown to be necrotic. Hæmorrhage was stopped by sponge pressure and clamps. A chain of deep sutures was then inserted, surrounding the whole field.

An incision through the scalp to the bone was now made, about two inches anterior to the wound, parallel with it and of equal length. Underneath this flap the external table was chiseled free from the skull. This external table was carefully left in continuity with the scalp bridge. Some slight infraction occurred, of course, but this mobilized bony shell, together with the overlying bridge of the soft tissues, formed one firm, well nourished

Fig. 1

Fig. 2

Fig. 3

segment. In the central region, this bony bridge was made about 1½ inches wide, so that it would overlap the edges of the bony defect.

After sufficient freeing of the parts laterally the thoroughly freed bridge was pushed and pried backward like a visor of a helmet over the bony defect and somewhat over the edge of the bony rim behind. This hindered the formation of a bony depression at that point and held the bridge well fixed in position.

The soft parts of this bridge were approximated with the posterior rim of the wound by sutures extending deep into the scalp. In front of the bridge there was a corresponding defect in the scalp, which was simply left open.

A bulky dressing with starched bandages was applied and a galvanized zinc plate was molded over the bandage for additional protection.

Three days after the operation we made the note that the patient's mental condition was quite normal apart from a little general apathy and slowness. Sixteen days after our operation the patient went home. The temperature had never reached 99°, and the open scalp wound in front of our bridge flap was rapidly closing.

After the operation there was no further loss of brain substance, the suture line behind the plastic flap healing promptly and firmly. About a year after the operation the patient resumed his regular work.

A recent report says he is married and well, with no dizziness, but still a defect in the sight of each eye, a homonymous leftsided hemianopsia.

It would seem that this method of a bridge flap including the external table, which is slid over the defect in the skull in the manner of a visor of a helmet would be practicable in most regions of the skull. The dependably secured nutrition for the flap, the firm and steady pressure of the flap upon the defect, the degree of which can be chosen by the greater or less width and obliquity of the pedicles of the bridge, and finally the hermetic bony closure of the defect are the outstanding benefits of this procedure.

BLOOD TRANSFUSION SIMPLIFIED BY THE USE OF CITRATE OINTMENT

The Biologic Test for Blood-Incompatibility

By HENRY W. ABELMANN, M.D., Chicago

IN the last three years I have given blood transfusion a great deal of attention and study, and the results which I have obtained are flattering to the superlative degree. I am convinced the blood transfusion when properly handled is entitled to be classed among the best therapeutic measures in treating certain disease conditions. Owing to difficulties and risks it has seldom been used.

However, with the modern improvements in technique as well as the new test for blood-incompatibility the difficulties, dangers, and inconveniences have been largely overcome and at the same time the therapeutic results have been

improved. In recent years Lindeman, Kimpton, Lewisohn, Percy, Brewer, Crile and others have accomplished much in reviving and making popular blood transfusion.

The method which I have developed has for its chief object, simplicity and safety and this is true as well of the new test for blood incompatibility. The technique and the instruments have been perfected for the purpose of providing a way and means by which the transfusion of blood can be accomplished by one person with certainty and ease without any assistance; also with the idea of eliminating dangers and inconveniences, which in the past have caused the physician to hesitate to employ this valuable therapeutic measure in the treatment of disease. I use the syringe method only and have perfected it by the invention of an ointment to prevent the coagulation of blood.

That blood coagulation and blood incompatibility are the chief obstacles to be overcome, cannot be denied. While the ointment is a highly effective anticoagulant medium, the new test which I call the biologic test for blood incompatibility makes for safety in transfusion. This test has shown that there are different types of incompatibility, and that we do not merely have to deal with hæmolysis and agglutination; furthermore I have found that the biologic test is far more accurate and much more simple than the laboratory tests. Many of the fatal and disastrous results which have occurred in blood transfusion have undoubtedly been due to the administration of blood which the laboratory tests have failed to prove toxic. Fatalities have also followed the transfusion of too great a quantity of blood (massive transfusion) in very anæmic individuals. In three years I have given over 1500 blood transfusions and I have not had one fatal result or a serious mishap to record. My experience in blood transfusion has been largely in treating certain anæmias and chronic infections, and it has many times proved to be a lifesaving procedure where medicine and surgery have failed to restore health. I have used it on patients who have had to undergo major operations but were too weak and debilitated to be operated on, and repeatedly their condition has been improved in a short time so that the operation could be performed with but little risk. I have used transfusion to hasten the period of convalescence after operations and in patients debilitated from long-continued fevers. Blood transfusion has been a successful therapeutic measure to allay pathologic hæmorrhage; not infrequently it is effective in relieving pain; and good results have been obtained in patients afflicted with nervousness and sleeplessness.

As the simplicity of the modern methods and the safety with which the operation can be performed as well as the advanced therapeutic value of hæmotherapy become better known, blood transfusion will have its field of usefulness extended and it will be more generally employed than it is at the present time.

METHOD

The blood is aspirated from the vein of the donor into the syringe, the inner wall of which has been covered with a thin coat of the citrate ointment. By this procedure a known quantity of blood can be aspirated, while its injection into the vein of the recipient is under absolute control. Speed and dexterity are not required to carry out the transfusion successfully, and no anticoagulant solutions, which have their disadvantages, are necessary.

I have found that the transfer of small doses of blood (120 to 240 cubic centimeters) at intervals of 3, 5 and 7 or more days, according to the indication or judgment of the attending physician, not only is safer for both donor and recipient but also is productive of the best therapeutic results. I use the Luer (all glass) graduated 100 cubic centimeters and the Luer 25 millimeter (hypodermic) syringes. The larger syringe is fitted with a short rubber tube 3 centimeters long. By using the flexible connection between needle and syringe, it is possible to hold the syringe in various positions and at the most convenient angle without affecting the position of the needle, thus minimizing the possibility of traumatizing the vein. The rubber also protects the nipple of syringe from chipping.

Transfusion needles (Figs. 1, B and 2, B). The transfusion needles which I have devised, possess certain features which are of particular advantage. The needles, 4 centimeters long, 18 or 19 gauge, slip-joint and interchangeable with the syringes, are provided with a guide which indicates the correct position of the cutting edge of the needle and serves as a gripping portion, lending ease and control to the operation, and also by means of which it can be handled without the danger of contamination. The wings which spread from under the proximal end of the needle serve to embrace the vein without compressing it, thus assuring the free flow of blood. The claws at the distal end of the wings serve to fix the needle which prevents its slipping out of the vein or piercing its posterior wall. When the needle is placed on the tray, the wings serve to

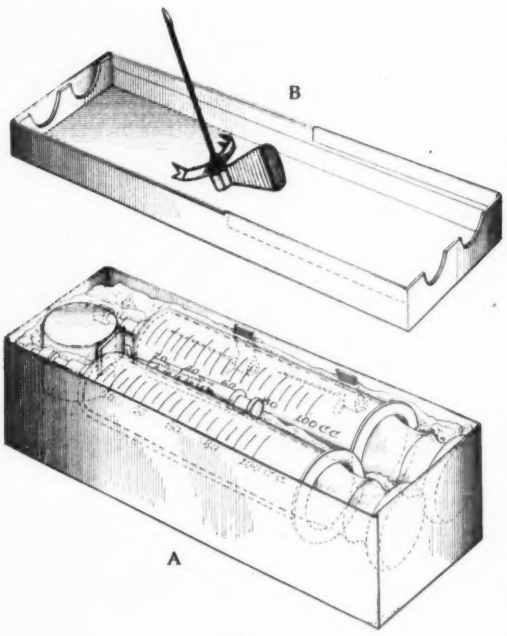


Fig. 1

keep the gripping portion in an upright position, thus enabling the operator to pick up the needle with ease, while the shaft of the needle is directed upward at an angle of 45 degrees, whereby inadvertent contact and the rubbing off of its coat of ointment is prevented. The needle has a flat cutting edge which works much more satisfactorily than a pointed one. After being properly prepared, the syringes and transfusion needles are packed in sterile gauze and placed in a container (see Fig. 1, A). They are then ready for immediate use in any emergency. The extension cover of the container (Fig. 1, B and Fig. 2, A) is utilized as a syringe tray, its construction being such that when employed for this purpose, it has stationary syringe holding portions accommodating two syringes, holding them in properly spaced relations and preventing them from rolling (thus avoiding breakage). They also serve in keeping the transfusion needles and pistons in the sterilized field (thus avoiding contamination). The syringe-holding portions also prevent the piston from sliding which obviates the inadvertent dripping of blood or the entrance of air into the syringe. The extended portion of the cover serves as a drip pan and is telescopically engaged with the remainder of the cover.

The ointment. When I first began to employ blood transfusion, I used a citrate solution in conjunction with petrolatum. After some time I came upon the idea that an ointment having for its chief ingredients, sodium citrate and petrolatum would save time and simplify the operation; and I set about to compound such an ointment. After much experimenting I found that adeps lanæ which is anhydrous was the most suitable for the purpose. The following formula gives the best results: Adeps lanæ, 10; aqua destillata, 10; natrium citratis, 10; petrolatum, q. s. ad 100. The specific action of the natrium citratis and the petrolatum is enhanced by the adeps lanæ, which makes it possible to combine the natrium citratis with the petrolatum. The ointment aside from serving as an effective anticoagulant has other important functions to fulfill, which are necessary for the successful transfusion of blood. In the first place it hinders blood from intruding between piston and barrel of the syringe, thus preventing sticking of the piston. It also hinders air from being drawn in at the proximal end of the syringe during the aspiration of blood, so that the syringe can be filled to its full capacity (120 cubic centimeters). The ointment possesses an excellent lubricating body which facilitates the easy sliding of the piston. It provides a medium which excels the covering property of petrolatum and possesses sufficient adhesive quality to cling to the syringe and needles without loosening and getting into the blood.

The preparation of syringes. It has been my experience that repeated sterilizing of the syringes by boiling eventually breaks them; therefore I sterilize my syringes in alcohol, except when working with a new set for the first time, then I boil them 25 to 30 minutes. When sterilizing with alcohol care must be taken that all the alcohol has been evaporated, which is accomplished by aspirating and expelling sterile hot water (not boiling water). The syringes are then taken apart and after a few seconds they are dry and ready to be coated with the citrate ointment. A small quantity of the sterile ointment is heated to the liquid state and taken up into the syringe. By holding the syringe in an upright position and by moving the piston slowly up and down, the inner wall of the syringe is covered with a thin coating. It is advisable to stir the heated ointment well before aspirating it into the syringe. The piston is coated by dipping or pouring hot ointment over same. The excess of the ointment is forced out of the syringe while it is still hot, to prevent the occlusion of the small parts of the

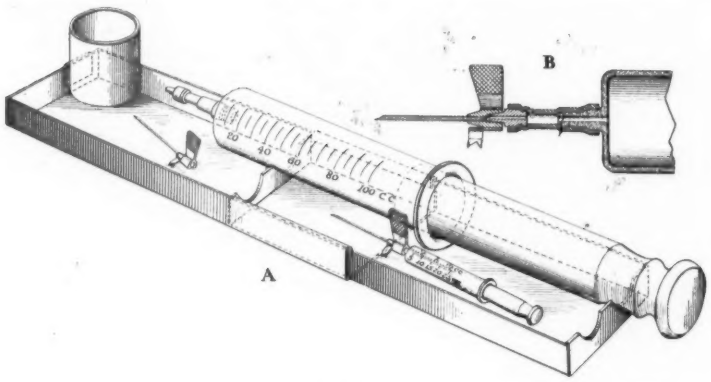


Fig. 2

syringe. Since employing this method of sterilization, no syringes have been broken during the two and one-half years in which I have used it, whereas previous to this breakage by boiling was not an infrequent occurrence. The needles can be anointed by attaching them to the hypodermic syringe and aspirating and expelling the hot ointment.

Preparation for transfusion. The instruments are placed on the syringe-tray (extended case cover) on sterile gauze. Next, test the transfusion needles to make sure that they are not occluded with the ointment. This is done by attaching them in turn to the hypodermic syringe and taking up and forcing out the following solution; 2 per cent natrium citratis in 0.8 per cent NaCl solution. Then attach needles to their respective syringes. When the syringes have been properly prepared and tested there is no danger of injecting ointment into the vein. The needle as well as the rubber connection and neck of syringe is filled with the solution (2 to 3 cubic centimeters) for the purpose of excluding the air in these parts. The instruments are now ready for the transfusion.

Preparation of recipient and donor. The patient and donor are brought in a comfortable recumbent position. The flexor surface at the bend of the elbow is sponged with 95 per cent alcohol and a moderately tight tourniquet is placed around the arm of both donor and recipient. I employ rubber tubing about 27 centimeters long and 0.7 centimeter in diameter; two such tubes are used as a tourniquet. The double tube works more satisfactorily and assures a more uniform compression. They are applied in such a manner that when pulling one of the ends, the tourniquet is easily and quickly removed. Experience has taught me that palpation of the vein is the best guide to ascertain whether or not the tourniquet is too tight or too slack. The proper compression will keep the vein constantly refilled as aspiration goes on and will prevent the wall of the vein from being sucked into the mouth of the needle, thus assuring the free flow of blood. The forearm should be held in extreme extended position. The closing of the hand tightly will compress the deep veins, making the superficial ones still more prominent and also less collapsible, thus rendering the puncture of the vein easier. It is always advisable to use sharp needles; dull needles will collapse the vein or push it aside, causing pain, unnecessary traumatism, ecchymoses, besides making the puncture of the vein difficult. The arm must be dry (free from alcohol) before the puncture is made.

Aspiration of blood. The transfusion needle is thrust into the most prominent and best accessible vein of the donor. It should enter the vein in the direction of the blood current as it affords the most convenient position for aspirating blood. The valves in the vein will sometimes obstruct the free flow of blood by being aspirated into the end of the needle; experience will teach how this can be avoided. The blood is aspirated slowly and steadily and when the syringe is nearly filled (100 cubic centimeters) the tourniquet is removed. The donor's hand is now opened and the excess of blood in the vein is aspirated before the needle is withdrawn. A sterile sponge (kept in readiness) is applied to the puncture wound, the donor making compression with the finger over or just below this point, until the operator has completed the transfusion, when a loose binder is applied, which

Fig. 3

is left on for at least 12 hours. By placing the middle of the binder on a bias over the site of puncture, bringing one end around the back of the arm and the other around the back of the forearm, then tying them over the front of the elbow, free motion in the joint is allowed, while at the same time the slipping of the bandage is prevented.

Now place the syringe on the tray and then remove the needle.

If the above technique is properly carried out, it is not likely that extravasation of blood into the subcutaneous tissues will take place.

Injection of blood. Another transfusion needle attached to the hypodermic syringe which is filled with 10 millimeters of the solution is thrust into the most prominent and accessible vein of the recipient. As soon as the needle enters the vein, the blood-pressure will push the piston outward, which is sufficient proof to the operator that the needle is in the lumen of the vein. The tourniquet is now removed and the hand opened and the contents of the hypodermic syringe emptied into the recipient's vein. The removing of the tourniquet and opening of the hand relieves the intravenous pressure, which in conjunction with the capillary force of the needle prevents bleeding when the hypodermic syringe is disengaged. The blood-filled syringe is now connected to the needle in the arm, and its contents injected slowly into the recipient's vein. If more than 120 cubic centimeters of blood is to be transfused, two syringes are filled with blood and placed on the tray and injected in turn. The puncture is treated as mentioned above. When repeating the transfusion I usually use the same puncture wound.

It is interesting to know that the instruments aside from being useful in blood transfusion, are also admirably adapted for any intravenous medication (salvarsan, etc.). Blood-letting which is being revived and which is a valuable therapeutic measure is rendered very simple and easy by the use of the apparatus.

An easy way to sterilize the solution and always have it ready for immediate use, is to fill a dozen four ounce bottles half full of the solution and place them in a water bath and boil them 30 minutes (corks can be boiled at the same time). The contents of one bottle is poured into the solution cup (which is attached to the transfusion tray) and is sufficient for testing the needles to make sure that they are in good working order, as well as for rinsing out of syringes and needles after the completion of the operation which renders cleaning easier at a subsequent time. The ointment in the syringes is wiped out with sterile gauze, and the ointment in the small parts is removed by aspirating and expelling sterile hot water. They are then ready for the alcohol bath.

BIOLOGIC TEST FOR BLOOD INCOMPATIBILITY

The physiologic reaction following the injection of the donor's blood into the recipient's vein manifests itself by certain signs and symptoms (early manifestations), which indicate whether or not the prospective donor's blood is suitable for the transfusion. In performing the test, the same technique is employed as for the transfusion, except that the larger syringe is filled with 40 cubic centimeters or more of the solution (2 per cent natrium citrate in 0.8 per cent NaCl solution) into which 20 to 40 cubic centimeters of the donor's blood is aspirated. As even small

quantities of incompatible blood may give rise to severe reactions, it is necessary to so dilute the donor's blood as to render the injection safe. The severity of the reaction is further controlled by injecting the blood slowly and in small quantities (1 to 2 cubic centimeters) at intervals of 10 to 15 seconds, while at the same time closely observing the patient. The following are some of the signs and symptoms, which for simplicity sake are given promiscuously without regard to any particular type of blood incompatibility.

Flushing of the face, feeling of oppression in the chest, increased respiration and shallow breathing, pain in the sacral region; (headache, nausea and vomiting, rarely occur except when larger and concentrated doses of highly toxic blood is injected). Any one or a combination of one or more of the above-mentioned signs and symptoms usually appear in one to five minutes after the injection and disappear in about five minutes. They are usually followed by a chill (late manifestation in from 20 to 45 minutes). After the chill one or more of the following symptoms may arise: elevation of temperature, perspiration, tired and sleepy feeling, yawning, aching of the muscles, hæmoglobinuria, etc. If an experienced operator performs this test, patients suffer very little inconvenience from the reaction, as the injection is at once discontinued when signs of incompatibility begin to manifest themselves. Should no signs of incompatibility occur after a period of three to five minutes, the remaining blood in the syringe can be safely injected. It happens that certain types of incompatible blood will not produce the initial symptoms, but will give rise to late manifestations (chills, etc.). In my experience, blood of this nature is seldom found but if it is it has proved to be less toxic.

I have repeatedly demonstrated that blood of moderate incompatibility when given in small doses, can bring about beneficial results without apparent harm to the patient and that absolute compatibility is not always essential. This, however, can be graded best by individual experience. It is also to be remembered that blood of a mild toxic nature is liable to become more toxic with subsequent transfusions (manifestations of anaphylaxis?). Should the blood of the first donor prove to be incompatible, it is advisable to wait until the late reactions have passed over before another test is made. It is perhaps best for the beginner to familiarize himself with the new test by using the laboratory tests first, and supplimenting them with the biologic test; in this way doubly safeguarding the patient from the danger of blood incompatibility, until ample experience has been gained. This subject will be touched upon again under the heading, "Special and Important Advantages of the Method."

It goes without saying that the donor must be healthy. A thorough physical examination should be made and the history carefully taken. Blood examinations are often helpful in determining the existence of infective disease and where the slightest suspicion exists they are imperative. Individuals between the ages of 18 to 25 years are best suited for donors.

SPECIAL AND IMPORTANT ADVANTAGES

The administration of small quantities of blood. The transfusion of a small dose of blood (120 to 240 cubic centimeters) at intervals as the condition of the patient warrants, not only brings about the best results in treating certain chronic diseases, but also frees blood transfusion of many of its dangers.

Repeated transfusions. An important safeguard for both donor and recipient lies in the fact that the transfusion of blood can be repeated at chosen intervals. The practical application of this is rendered possible by the simplicity of the method as well as of the apparatus. The taking of large quantities of blood at one time often leaves the donor in a weak and debilitated condition, which renders him easily susceptible to disease. Cases are known in which the immediate and even the remote effects of large withdrawals of blood proved fatal. My experience has been that with the extraction of small quantities, donors usually make up for the loss of blood by gaining in weight during the intervals of transfusion. In no case have there been, to my knowledge, any untoward effects as the result of withdrawing small doses of blood at chosen intervals, on the contrary many of the donors feel better after this procedure. The recipient's blood making organs are stimulated by small and repeated transfusions, as shown by the increase in hæmoglobin during the intervals of transfusion. It is the increase in the patient's own blood which is induced by the repeated transfusions, that adds to the efficiency in treatment and frequently less blood is required to bring about results when it is administered in small and repeated doses. Massive transfusions not only invite certain dangers but are often less effective in treating chronic anæmias.

With the administration of large quantities of blood, especially to patients suffering with high grade chronic anæmia, the strain and shock to the weak and anæmic organs is great. The

heart in particular is over taxed in its effort to force blood of a greater viscosity through the capillary system. As the laboratory tests are not always reliable, the transfusion of large quantities of unrecognized toxic blood is liable to cause alarming symptoms and even death which may result suddenly or in a few hours or days. This danger is practically eliminated by the small repeated transfusions as well as by the use of the biologic test for blood incompatibility.

Blood incompatibility. The biologic test is a very important safeguard developed by this method. In the large number of cases in which I have performed this test it has proved to be safer and more satisfactory than the laboratory tests. It is so simple that the average physician can usually determine within one to five minutes, and with a maximum degree of certainty whether or not the prospective donor's blood is suitable for the transfusion. Furthermore it has repeatedly demonstrated the unreliability of the laboratory tests, and has shown that there is more to blood incompatibility than mere hæmolysis and agglutination. Although the modern improvements in laboratory testing of blood have diminished the danger of blood incompatibility, nevertheless a certain amount of danger exists; besides laboratory tests require expert work, are time consuming and are more or less complicated.

I have employed the biologic test solely during the past two and one-half years with gratifying results. Whether or not it is advisable to recommend its general use in this way (especially to the beginner) is an open question. It will, perhaps (in the hands of the average transfusionist), be employed as a valuable and necessary adjunct in testing for blood incompatibility and as a double safeguard in blood transfusion.

Therapeutic blood test. The chief factors in hæmotherapy on which much of the success of treatment depends, I believe, lies first in the selection of compatible blood for the patient, and second in the selection of suitable blood for the disease. To my knowledge the selection of suitable blood for the disease has never received attention. While the blood to be transferred may be compatible, it is not always said that it is also suitable to combat the disease. This has been my experience in several cases in which healthy compatible blood had been transferred without much apparent change in the patient's condition. However, upon selecting another donor whose blood was also healthy and compatible, the patient improved rapidly with the diseased parts clearing up simultaneously. The most plausible explanation of this phenomenon seems to be that the blood of the first donor offered little or no resistance to the particular germ, while the blood of the second donor proved to be noxious to the infectious micro-organism. The fact that the chemical make-up of blood differs offers at least one explanation why some individuals are less susceptible to certain infectious diseases than others. It is obvious that this therapeutic test will enhance the value of blood transfusion in the treatment of disease.

Dangers eliminated. The method precludes the possibility of transmitting disease from patient to donor, as the patient's blood at no time comes in contact with the donor. The danger of air and clot emboli, also thrombosis and infection is practically nil. The possibility of contracting (anaphylaxis?) is minimized owing to the greater reliability of the biologic test. The danger of acute dilatation of the patient's right heart by too rapid transfusion of blood is avoided; as the rate of flow of blood into the patient's vein is under absolute control, also the exact amount of blood aspirated and injected is known.

Inconveniences overcome. The transfusion can be performed by the average physician with safety and ease, in a short time and without the aid of any assistance. The operator requires no speed or dexterity (the blood does not clot). The method requires no cutting consequently there will be no offensive scars, no destruction of blood-vessels and nerves and no wasting of blood. I have repeatedly transfused blood without spilling a drop. The operation requires no local or general anæsthetics, as it is practically a painless procedure. Donors are readily secured on account of the simplicity, safety and convenience, and are not incapacitated from attending to their work. For obvious reasons professional donors are undesirable subjects, in fact I have never employed them as the friends or relatives of the patients have always been willing to serve as donors.

The transfusion can be performed in the physician's office, with the donor and recipient sitting at a table (see Fig. 3). Upon completing the operation both parties can be dismissed immediately. Before office treatment can be undertaken, however, it is necessary that the blood incompatibility be previously determined. This is usually possible after the first transfusion. As the psychological effect of seeing blood may cause fainting, it is advisable to restrain the donor and recipient from watching the operation.

The apparatus is compact, can be carried in a coat pocket, is easily sterilized and prepared, and can always be kept ready for immediate use in

any emergency. The instruments are also admirably adapted for the administration of salvarsan and other intravenous medication. Blood-letting is rendered simple by the use of the apparatus. On the whole, the citrate ointment syringe method of blood transfusion should appeal to the average physician as the most desirable routine method.

CÆSAREAN SECTION, LOCAL ANÆSTHESIA

By HUGH H. TROUT, M.D., Roanoke, Virginia

IN presenting this paper, we appreciate fully we have employed local anæsthesia in some cases in which there were no contra-indications to a general anæsthetic. However, as all such patients have had so little pain, and no shock, we feel justified in having followed this course in order to test the practicability of a method to be applied in those cases in which a general anæsthetic adds gravity to an already grave situation.

Since Einhorn gave to the surgical world novocaine, most of the major operations of surgery have been performed with its use, but a search of literature failed to show an abdominal cæsarean section done with this anæsthetic up to the time of our first case. However, since then, Dr. Clarence Webster reported fourteen cases in Surgery, Gynecology, and Obstetrics, February, 1915. Most of his cases preceded our work along this line, and he certainly deserves all credit for priority.

In our series we have had 18 cæsarean sections done with local anæsthetic, and a considerable number of others with general.

Why this field of surgery has not been more utilized by the advocates of local anæsthesia, is difficult to understand, for frequently where the necessity for such an operation is present, the contra-indication to a general anæsthetic is marked, and we are convinced the procedure offers few real difficulties, and can be done with relatively little pain — certainly nothing like as much as normal labor.

It is, of course, necessary for any surgeon attempting this work to be accustomed to the employment of local anæsthetics, and any operator expecting to gain entrance painlessly into the abdominal cavity should certainly be familiar with the great work of Lennander on the sensibility of the various viscera and parietal peritoneum. Curious to note, Lennander does not mention the sensibility of the uterus, either in the pregnant or the non-pregnant condition, further than to state: "All organs receiving their nerve supply only from the sympathetic nerve and from the vagus, below the branching off of the recurrent nerve have no sensation. According to my observations, therefore, the abdominal and pelvic viscera are devoid of nerves, to convey the sense of pain, pressure, heat or cold."

The truth of the above quotation has been impressed upon us very forcibly during our operations on the pregnant uterus; namely, the patients have no pain when the uterus is being incised, but do complain of nausea and pain to much traction, which latter condition is what would be expected, but certainly the former state of affairs is an important and somewhat unexpected observation. We have purposely told four patients before we started to incise the uterus, and none have complained of pain during the entire incision, but all did have pain when we lifted the child and membranes from within the uterus. This, of course, helps prove Lennander's contention that there is pain to the slightest traction on the mesentery or parietal peritoneum. This point is further demonstrated in the fact that in all 18 of our cases, the most painful part of the operation was the lifting of the uterus out of the abdominal cavity.

The technique of the operation, as we have followed it, is briefly as follows: Operation preceded by morphia, ⅙; novocaine, ½ of 1 per cent; with three drops of adrenalin to the ounce is the solution employed, and of this, we have used as high as 250 cubic centimeters. In the last 11 cases, we have omitted the adrenalin, and could see no difference in the duration of the effect of the anæsthetic or the amount of bleeding.

The skin is infiltrated in the usual manner by forming one wheel after another. In the first five cases we made the incision from the pubes upward until we could have room to deliver the uterus, but during the last thirteen, we made the

Fig. 1

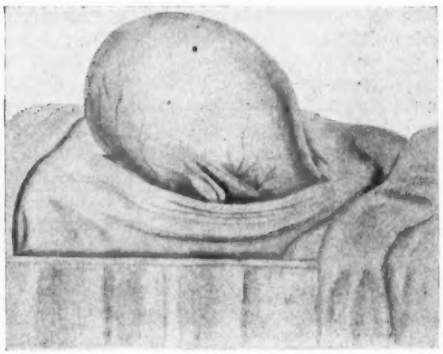


Fig. 2

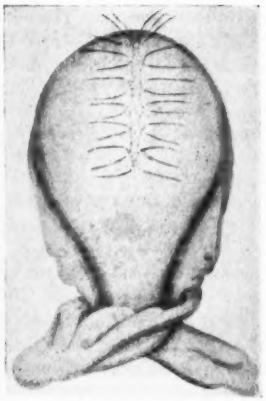


Fig. 3

Fig. 4

Fig. 5

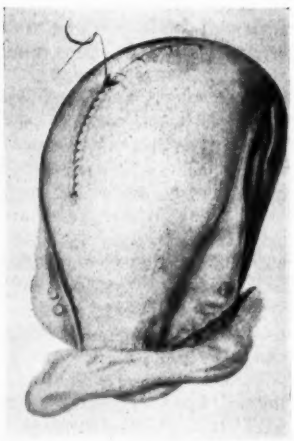


Fig. 6

middle of the incision about the level of the umbilicus, and the upper end about on a level with the fundus of the pregnant uterus (Fig. 1). The fascia is infiltrated exactly in the same manner as the skin, and muscles are usually so thin the fibers separate without trouble. A small opening is then made in the peritoneum, and index finger of left hand inserted and peritoneum infiltrated, keeping this finger on the inside as a guide for the needle, while injecting this very thin membrane. This part of the operation is far easier than is commonly supposed. The uterus is lifted out of the abdominal cavity, and moist sodium citrate and sodium chloride pads or towels placed between it and the intestines.

It is important to have the upper portion of the abdominal incision so placed as to be slightly higher than the fundus of the pregnant uterus, and in this manner, the uterus can be allowed to "ride out" of the peritoneal cavity; thus removing what is sometimes the only painful part of the operation. If the incision is not too long, the abdominal wall will "hug" the uterus and serve to retain the intestines without the use of pads, etc. (Fig. 2).

As a matter of precaution, and to save time after incision of the uterus, we place a line of interlocking sutures of chromic catgut, on each side of the fundus of the uterus (Fig. 3). These lines are about one inch apart. The sutures are

placed as follows: The points of entrance and exit are about 1½ inches apart. The next suture has its point of entrance half way between the two above points, and this manner of inserting sutures is continued until about eight to ten sutures are placed in each side of the future line of incision. As these sutures are placed in the direction of the long axis of the uterus, it is easily seen a line of sutures so placed will interlock one another, and control all bleeding. These sutures go through the whole muscular wall, and an assistant on each side makes traction on the entire line, thus lifting the uterus up, steadying the same, and controlling the hæmorrhage (Fig. 4). After delivery of the child and membranes, these sutures are tied across the line of incision, and in this manner, we have at least eight double mattress sutures which not only control the hæmorrhage, but give fairly accurate approximation (Fig. 5). This whole suture line is covered over by means of a continuous suture of plain catgut, approximating the peritoneal surfaces, leaving no raw surfaces for future adhesions (Fig. 6). The abdominal incision closed in the usual manner.

The following is a very brief synopsis of the eighteen cases:

ECLAMPSIA — 9 CASES

Three mothers died, all having had convulsions before operation; six children were born dead, three living. There was very little dilatation of cervix in any of these cases. Forceps delivery was attempted previous to operation in all three cases that died, no forceps in the remainder of the series. All cases having had convulsions presented an aura of radiating epigastric pain. There were six primiparæ and three multiparæ.

CONTRACTED PELVIS — 5 CASES

All mothers living, three children living, and two born dead.

PLACENTA PRÆVIA — 2 CASES

Both mothers living.

PYELONEPHRITIS

One case of pyelonephritis was not relieved by urethral catheterization, etc. and the patient was very toxic.

The mother is living, the child born dead.

UTERINE INERTIA IN PRIMIPARÆ — ONE CASE

There was one case of uterine inertia in a primiparæ. The patient was in labor over 48 hours, without any dilatation, and collapse of mother.

The mother and baby are living.

From our experience with those cases, we are convinced where the condition of the mother makes the giving of a general anæsthetic, unsafe, the employment of novocaine is indicated, and its use does not present the difficulties one would naturally expect.

THE ACTION OF "FEMALE REMEDIES" ON INTACT UTERI OF ANIMALS

By J. D. PILCHER, M.D., and ROY T. MAUER, Omaha, Nebraska
Laboratory of Pharmacology, School of Medicine, University of Nebraska

THIS paper concludes the study of the so-called *female remedies*. In former publications[1] it has been shown that while a number of these preparations affect the activity of strips of the excised uterus, they have a similar action on strips of intestine, so that the action was considered to be on smooth muscle in general and not specific to the uterus. Further, from the concentration of the solution necessary to demonstrate their actions on excised tissues it was concluded that doses too large to be tolerated would be required to display a similar action on the intact organism. The present study was undertaken to settle these questions, for there was a possibility that the drugs might influence the uterus through a central action, although there is no pharmacological basis for this view.

Methods. The movements of the uterus were registered after the method of Barbour.[2] The fallopian tubes of the anæsthetized animal were freed from their adnexa and supported in a glass cylinder that was fastened in the belly wall and communicated with the abdominal cavity. The abdominal cavity and the cylinder were filled with warm paraffin oil, thus immersing the uterus in a warm, inert fluid. The contractions of the uterus were recorded. Cats, rabbits and dogs were used, the last being much more satisfactory. With but one exception all the animals were non-pregnant, as they are more suitable for the method employed. One dog in the very early stages of pregnancy gave similar results. The blood pressure from the carotid artery was simultaneously registered in the experiments on dogs but, because of the lack of resistance of cats and the rabbits, it was thought

[1] J. Am. M. Ass., 1916, lxiv, 490; Arch. Int. Med., 1916, xviii, 557, 752.

[2] H. G. Barbour. J. Phar. & Exper. Ther., 1915, vii, 547.

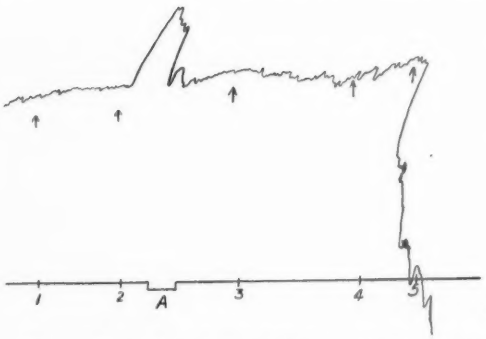


Fig. 1. The action of several drugs on the movements of the intact uterus of a virgin dog. The upper curve is a record of the contractions; the base line is below; *A* represents 60 seconds. (*1,2,4,*) the drugs were injected by vein in doses of 0.04 cubic centimeter per kilogram; Jamaica dogwood, pulsatilla and blue cohosh respectively. This dose made a concentration of about 1:1000 in the blood. At *2* a small dose of histamin was given and at *5* an injection of epinephrin, the latter causing the lever to fall below the base line. The tracing was interrupted between *3* and *4*.

best to omit the blood pressure records on these animals, after preliminary work had shown that the blood pressure was unaffected by all the drugs except blue cohosh.

The rabbits and cats were etherized and pithed through the foramen magnum; curare was not required in the pithed animals. The dogs received a preliminary injection of morphine sulphate (3 to 5 mg. per kilogram) and were then etherized and lightly curarized. Barbour (2) demonstrated that morphine was practically void of action on the contractions of uteri of cats and rabbits and our work on dogs confirms his observations, for the uteri contracted well in all the experiments. A large dose (about 3 mg. per kilogram) of morphine sulphate was given by vein in a single instance and caused a marked temporary increase in tone; at the same time the blood pressure fell much below normal but soon returned to the previous level; this result also confirms Barbour's findings.

Dosage. It was aimed to give the maximum amount of the drug so that the concentration in the blood would approximate that (1:1000) of the solutions used in work on the excised uterus. Considering the total quantity of blood as about 5 per cent of the body weight, it would require 0.04 cubic centimeter of the fluid extract per kilogram of the animal weight to reach this concentration. This dose would be from 2 to 10 times the adult dose of most of the preparations used. Further, the drug was always given by vein, which would make the concentration proportionally larger, for the remedies are ordinarily administered by mouth. The doses used then were always several times larger than the ordinary therapeutic dose. Even larger amounts were administered in a few experiments but because of the heavy precipitate of resins formed by diluting the extracts with saline solution it was thought best not to employ them for intravenous administration.

The experimental results. The following drugs[1] were examined and were found to be without action (Fig. 1): unicorn root, pulsatilla, Jamaica dogwood, figwort, valerian, lady's slipper, wild yam, life root, skull cap, blue cohosh, black haw (Viburnum prunifolium), cramp bark, squaw vine, false unicorn, passion flower and motherwort.

The experiments were made under various conditions: when the tone of the uterus was considered to be normal, when it was much above and much below normal; when the uterus was contracting normally with unusual vigor, very slightly, or not at all. The question of the tone of the uterus is emphasized because it is claimed that some of these drugs, at least, are both tonic and sedative and the results demonstrate that they are neither the one nor the other.

All levels of blood pressure from 180 millimeters to 50 millimeters of mercury were present. Control experiments (epinephrin) gave the normal reaction at low levels of blood pressure. Because of the normal variations in the activity of the uterus it was necessary to perform a somewhat larger series of experiments than would have otherwise been warranted; usually at least six to eight experiments were made with the drugs that had been shown to be active on the excised uterus, while but two or three injections were made of the inactive ones. When results other than negative were obtained, they were not uniform, that is, instead of the uterus being either uniformly stimulated or depressed, the results were variable. When an atypical result was obtained the rule was to follow it shortly by a second injection of the same drug to be sure that it was an atypical result. In the experiments on dogs control injections of epinephrin, which

[1] The drugs were the same as were used in the previous work; they were supplied by The American Medical Association Chemical Laboratory and their identity had been confirmed as reported previously. The common and botanical names are as follows: Unicorn root (Aletris farinosa), pulsatilla (Pulsatilla pratensis), Jamaica dogwood (Ichthyomethia piscipula), figwort (Scrophularia nodosa), valerian (Valeriana officinalis), lady's slipper (Cypripedium pubescens), wild yam (Dioscora villosa), life root (Senecio aureus), skull cap (Scutellaria lateriflora), blue cohosh (Caulophyllum thalictroides), black haw (Viburnum prunifolium), cramp bark (Viburnum opulus), false unicorn (Chamaelirium luteum), passion flower (Passiflora incarnata) and motherwort (Leonurus cardiaca).

inhibits the contractions and lessens the tone, were made, and occasionally histamin or pituitary extract, which increase tone; in all cases the normal action of the control drugs were obtained.

The effect on the blood pressure. Although the drugs were injected rapidly into the vein to insure the maximal action, there was no effect on the blood pressure, with the exception of two drugs; with the larger doses (0.04 cubic centimeter) of blue cohosh in the dog there was always a severe fall in the blood pressure of from 30 to 50 millimeters, with a fairly prompt return to normal. Immediately following the injection, the uterine movements were usually not affected, but at times there was either an increase or decrease in tone of considerable degree; even in the same experiment, however, the results did not agree, as in one case after the first injection the tone was increased and the contractions lessened, while after the second injection the tone was decreased and the contractions became larger; this could only mean that the changes in contraction were not due directly to the drug, or they would have been uniform. Doses of blue cohosh which did not change the blood pressure were without effect on the contractions of the uterus in the experiments on both the dogs and the cats; while in the latter animals blood pressure records were not made in the experiments in which the uterine movements were registered the large dose did not affect the blood pressure in control cats. Control experiments with epinephrin that did not change the blood pressure gave the usual decrease in tone and contractions. A fall in blood pressure, in itself, may have no effect on the curve, for passion flower twice caused a sharp fall in blood pressure without altering the uterine contractions.

CONCLUSIONS

The experiments demonstrate conclusively that the entire list of *female remedies* are quite void of action on the uterus *in situ*, thus confirming the interpretation of the results of the work on the excised uterus and intestine. They cannot, therefore, influence the tone or contractions of the uterus through any central innervation or through the blood stream, no matter whether the uterus is in a state of normal, increased or decreased tone. The following drugs were all found to be inactive in doses that were far above the average therapeutic dose: unicorn root, pulsatilla, Jamaica dogwood, figwort, valerian, lady's slipper, wild yam, life root, skull cap, blue cohosh, black haw (Viburnum prunifolium), cramp bark, squaw vine, false unicorn, passion flower and motherwort.

CORRESPONDENCE

BROWN'S IMPROVED HODGEN SPLINT

January 15, 1918.

To the Editor: From recent textbooks, reports in surgical journals and photographs of the splint most commonly used in the war for treatment of fracture of the femur, I infer a Hodgen frame suspension has been found to be the most satisfactory solution of the problem. Before any modification of this splint shall be accredited to any one now working at the front, I beg to recall to your attention an article which appeared in SURGERY, GYNECOLOGY AND OBSTETRICS for May, 1908, entitled "An Improved Hodgen Splint for the Treatment of Fractures of the Thigh or Other Painful Affections of the Lower Extremities" by Dr. George S. Brown of Birmingham, Alabama, now deceased. In this paper, which he read before the Southern Surgical Association, at New Orleans, December, 1907, will be found a full description of the splint as modified by him and all the points which have been recently claimed for it as to accuracy of result, simplification of dressings in compound wounds, comfort to the patient and ease in nursing care will be found fully discussed therein. His elimination of expensive and cumbersome trestlework over the beds, positive adjustment, continuous pull and many other details make the recently described splint as used in the war seem crude and in an evolutionary stage to those familiar with Brown's work. It is with an idea of giving credit for practically complete refinement of the details and management of this splint to the memory of Dr. Brown, where it properly belongs, that I ask the favor of publication of this letter.

JOSEPH A. MACLAY.

Paterson, N. J.

TRANSACTIONS OF SOCIETIES

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REGULAR MEETING HELD FEBRUARY 1, 1918; DR. CARL BECK, PRESIDENT

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DR. B. F. LOUNSBURY: This case of osteomyelitis is one of about six years' standing and was finally treated after the manner illustrated by Dr. Beck at the last meeting. The case originated as an acute osteomyelitis of the lower end of the femur. There was great swelling and pain and redness, accompanied by a high temperature. The bone was opened and considerable pus and necrotic tissue removed. The channel was kept open by a drain. The wound continued to discharge pus for months, through a narrow sinus. Finally Beck's paste was injected into the cavity. The discharge persisted, even after repeated injections. The whole channel was opened up again and a wider drainage attempted, but ultimately the space would fill in with granulations, leaving a small sinus with foul smelling discharge. About six months ago, a sliding skin-flap operation was done as described by Dr. Beck. The flaps were slid in from the side and held in the bottom of the bone channel. One of the flaps sloughed at the point where it turned over the edge of the bone. Fortunately, the other lived and epithelization has gone on until the channel is nearly covered. There is one small spot at the bottom which is still bare, but it is gradually being covered with epithelium.

The other case is that of a young man who fell from the cab of an engine, landing on his buttocks on the right ischium. The force was so violent that it disarticulated his pelvis, separating the symphysis pubis and the sacro-iliac joint. The whole right innominate bone with the right thigh could be pushed up until the crest of the ilium rested on the short ribs. There was a separation of about 3 inches at the symphysis. The ilium was driven upward on the sacrum, about 2 inches. There was a rupture of the urethra, but without urinary extravasation. There was very little traumatic shock. The patient was kept in bed with a weight on his leg for about 3 weeks until all the acute reaction of the tissues had subsided. He was then put on a Hawley table and the displaced innominate bone pulled down, a large flap was turned up over the symphysis, exposing the ruptured articulation. The cartilage was removed from between the pubic bones and they were laced together with bronze wire. The spines of the pubic bones were cut off and chipped up and placed between the raw edges of the two bones. The wound was closed and the patient turned on his face for the operation on the sacro-iliac joint. The entire sacro-iliac region was exposed with a flap incision. The ilium was forced downward on the sacrum and a hole drilled through the ilium into the sacrum. The cartilage was removed from the entire joint surface and the edges of the bones made raw. A bone peg was driven through the ilium into the sacrum. The posterior superior spine of the ilium was cut away and made into small fragments which were placed in the crack between the sacrum and the ilium. The wound was closed and a body cast from above the ilium encasing both legs, to the foot, was applied. The patient made an uneventful recovery and now, a little more than three months since the operation, is walking nearly normally. This operation was performed before the Clinical Congress of Surgeons, October 25, 1917.

I think there are two points in this case which should be especially emphasized: one is the necessity for removing the cartilage from the joint surfaces in order to get a bony union; the other is the necessity for immobilizing both legs in a cast to secure immobility of the pelvis.

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THE PRESENT STATUS OF THE SURGERY OF THE BILE TRACT

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It is worth while to bring out in these cases, the possibility of secondary cirrhosis of the liver, because in the last 4 or 5 years we have had in our service 5 such cases following common bile-duct obstruction. We should be more alive to that clinical picture which is not as common now as it was years ago because patients are operated on more regularly. But away back in the French and German literature, particularly in the French literature, we find a large number of cases of cirrhosis of the liver secondary to common duct obstruction either from stone, scar, or wound. The effect of damming of bile in the common duct is different in different cases, depending perhaps upon the degree of infection that is present and the peculiarities of the individual. In some cases the damming of bile in the liver produces destruction of liver cells from which the patients may die, even though the obstruction is relieved to a marked degree.

In one case the patient was jaundiced for only something like seven or eight weeks, when death occurred without any apparent cause except the liver destruction. In other cases the damming of bile does not produce any such serious effects. There may be a little development of connective tissue, and intermittent obstruction can go on for years without the development of destructive symptoms.

One of the striking things that happens after common duct destruction is that the jaundice disappears. I wonder if that was not one of the reasons in Dr. Bevan's case why reparation of the bile-duct was good because there was very little jaundice. After a little while the bile stops secreting biliary ingredients, bilirubin, and very little bilirubin being produced the jaundice gets less and less. In permanent obstruction, after two or three years, there is relatively little jaundice, even though bile-duct obstruction is complete. This woman had only a subicteric hue.

Other things happen in the liver and in various ways. Sometimes there are rapidly destructive changes while at other times there are slightly destructive changes. Bile acids are not produced in the early part of obstructive jaundice. The pulse becomes slow, due to the fact that the bile acids are produced and uniting with sodium salts act as toxins to the heart center. Later on, with less bile acid and less intoxication the pulse becomes faster.

I would like to call attention to the possibility of cirrhosis of the liver with its further clinical picture of enlarged spleen, heart and liver, and ascites, developing as a result of common duct obstruction. Let us not be fooled into thinking that the common duct is letting bile out when jaundice is reduced, but hold in mind the possibility of cirrhosis of the liver developing.

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DR. E. WYLLYS ANDREWS: One of the principal points the reader of the paper has called attention to is in line with what I have been thinking about lately in regard to the technique of cholecystectomy and its bearing on the character of dissection of the ducts of the gall-bladder. If one should apply the principle of large incisions which has been mentioned, to that small strategic point, I am coming more and more to think that in the technique of all these operations it would open up the possibility of avoiding all disappointment and complications of gall-bladder and gall-duct surgery. In other words, if we apply the principle of large incisions to that little strategic point, namely, the cystic duct, we will not blindly, as Dr. Bevan points out, put a clamp across the band of tissue which contains the duct and that very variable structure the cystic artery. The more carefully we dissect these structures, the more satisfaction we are going to have in our gall-bladder work for a number of reasons. If we do this as I saw the reader of the paper do it at the Presbyterian Hospital, with blunt dissection with Mayo scissors, the first thing we will uncover safely is the large tract of the cystic duct, either empty or full. Personally, I like to get a strong ligature upon it and use it as a sort of handle. If we mobilize it after we have made the section, we put it between clamps or ligatures, allowing the gall-bladder to become full. We will then have on one hand the stump of the duct and it will not contain the pedicle that has the artery. The artery pedicle will be separate. The practical importance of doing this thing one way more than another is this: by properly manipulating the stump and ligating it and dropping it and attaching it to a split tube and following it downward, we accomplish a great many things we never thought of before. Dr. Eisendrath has demonstrated this on his models and specimens. Among these things might be mentioned the fact that the cystic duct does not end where we think it does. It does not come to an acute or right angle in the end; on the contrary, the short piece you have there enters into the broad band which is called the gastrohepatic ligament. It contains three important structures, and among them the hepatic artery and the portal vein, and follows down that ligament of peritoneum parallel to the end a long distance. If you leave a long tube in that investment you will have too much and you are inviting trouble. I will go a step farther in that and say: let us take that little stump which we have and follow it out to its source and not only find where to empty it but open it. Suppose the bile does go into the vessel, is it not worth while as a principle in the technique of gall-bladder work to make a universal practice of laying open this communicating duct and getting right into the normal common duct, as the case may be, with probes. Many times we may overlook common duct stones. Every one of us has had the experience, in spite of skill in diagnosis, of overlooking common duct and hepatic stones and stones left in the ampulla of Vater. Lest this stump of duct magnifies itself until it looks like a big thing, it is easy to follow up and dissect, and in some of these cases we will be

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glad of it because we will find some trouble in the common duct in case we are at the point of closing it.

I have been interested in the last 10 months in the cholesterol content of the blood in its relation to gall-stones. We have had 30 odd cases inwhich there seems to have been a constant percentage of increase of cholesterol content in every case which has gall-stones. Therefore, that feature may have real diagnostic value in predicting the outcome of operations.

DR. L. L. MCARTHUR: In regard to X-ray pictures of gall-stones, I agree with Dr. Bevan that the claim of the roentgenologist that 30 to 50 per cent of stones are demonstrable by the X-ray is excessive. Of five cases in the last three or four years that have been turned over to me as gall-stones demonstrable by the X-ray, in three of them gall-stones were not found in the gall-bladder. In one of them there was a stone in the kidney, in the other two there were calcareous glands, one with the gland situated at the junction of the cystic with the common duct, which so frequently enlarges with ordinary gall-bladder disease, with typical calcareous degeneration, and in the other case there were two smaller glands, retroperitoneal. Jaundice from stone in the cystic duct will occur not infrequently with a very large barrel-shaped stone by mechanical pressure by the end on the common duct in the effort of the gall-bladder to empty itself. A large barrel-shaped stone, especially when as big as an ordinary spool will produce jaundice, and yet there may be none found in the common duct.

The great anxiety I have from a persistent jaundice in common duct obstruction from stone is not from hæmorrhage but from anuria which is almost sure to come on if a straight ether anæsthesia is given. This can be largely avoided by giving gas oxygen anæsthesia in such cases. I believe this ought to be done in every case where jaundice has existed for a long time, and if it should be given at all; it should be administered in the 4 per cent vapor by blowing the gas over ether. The anuria can be avoided if in introducing your tube into the common duct, after taking out the stone, you insert a small catheter into the duodenum, and a larger catheter up into the region of the liver, having two drainage tubes coming out of the external wound. You have then complete control of the bile. You have complete control of the stomach if there is nausea or vomiting. You have a means of washing bile out through the kidneys and alimentary tract by using much fluid through the tube which goes through the common duct into the duodenum. I have three such cases in the hospital at the present time with tubes inserted in that way. One of the patients is in a hospital at Lake Forest. He was reported as vomiting seriously. In this case I put two liters of normal salt solution through the tube in the duodenum. The vomitus then tasted a little salty, but the patient was soon in good shape. When you want bile to flow into the duodenum you connect the two tubes with a piece of glass tubing or eye dropper and bile comes up through the one in the common duct and thence back into the duodenum.

I do not agree with the essayist that when a gall-bladder appears normal externally, or because by compression it empties itself, or when there are no objective evidences of disease of the gall-bladder, it should be left unopened.

I recently operated on a nurse at the Michael Reese Hospital in whose case I was sorely tempted to remove the gall-bladder; nevertheless, I opened it and found flakes of bile and sand that were evidently making her trouble, so by opening the gall-bladder and emptying this out it was possible to discover what could not be discovered until I had opened it.

In regard to plastics on the common duct, in SURGERY, GYNECOLOGY AND OBSTETRICS for January, Ellsworth Eliot makes a report of 18 cases of plastic on the common duct. Of those 18 cases, I have been responsible for four, and the correction of a defect in the common duct has in my hands appeared simple and easy. I believe I am the first to have made that form of plastic which is known as the Sullivan duct. I operated before he made any report of his cases, my first operation having been done in 1908. I simply take a piece of rubber tubing of a size which will go into the proximal end of the common duct. At one end of that piece of rubber tubing is turned a double revere; you make thus the end of the tube larger than the new ampulla will be. If you plan to make that, you can be very well assured it will stay a considerable time there; then a pursestring is put in that portion of the duodenum which will somewhere nearly approximate the stump of the common duct. The duodenum may be mobilized so that it will come in contact with it. The tube is introduced into the duodenum to the extent of 7 or 8 inches for a special purpose, the other end is introduced into the proximal end of the duct and a few stitches put in to narrow it around the cuff that is on the proximal end of the tube. Pushing it down well into the duodenum, the pursestring on the duodenum is closed and one or two stitches are used tacking the stump to the duodenum. With that piece in place and another drain down to the line of junction, there is no leakage as a rule. After 8 or 10 weeks the tube is passed off by the constant milking of the intestine trying to pass that piece out. There is time enough for the epithelial structures to follow up as it gradually ulcerates its way through, the bile in the meantime passing through it. I believe that much can be accomplished by introducing a larger sized tube upward toward the liver and bringing it out through the common duct opening, and a smaller catheter (No. 6 or 8 French) passed down through the ampulla. If your patient needs fluids you can give them that way, or cathartics, without upsetting the stomach, and if you once try it you will like it.

DR. DANIEL N. EISENDRATH: I desire to show you a number of lantern slides illustrating some ex-

periments of the effect upon the cystic duct of removing the gall-bladder. A preliminary communication of this research work has already been published in the January, 1918, number of SURGERY GYNECOLOGY AND OBSTETRICS. These slides will show you quite plainly that the cystic duct dilates after cholecystectomy in dogs more in proportion than in any other bile-duct. It reaches its maximum at the end of four weeks and even in dogs killed at intervals of 3 or 4 months there is not much difference in size.

I also desire to show you some slides concerning an anatomical study which has not yet been published. We have secured our material from the Pathological Department of the Cook County Hospital, and I desire to thank Dr. Nuzum for permitting us to take these autopsy specimens.

The object of this study is to determine the frequency of the various modes of union of the cystic and hepatic ducts, and in 75 specimens thus far obtained we find that our percentages greatly resemble those of Ruge.

There are three principal types of modes of union: (a) The normal where the cystic and hepatic ducts unite at an acute angle well above the pancreas and duodenum. (b) Where the cystic and hepatic ducts run parallel to each other so that they either unite close to the upper border of the duodenum (short parallel type) or within the substance of the pancreas itself (long parallel type). In the latter some of the slides show where the union occurs, almost where the common duct meets the pancreatic duct at the ampulla of Vater. (c) Where the cystic duct winds either around the front or the posterior surface of the hepatic duct and enters the latter upon its left side. We have found the long and short parallel types in 28 per cent of the 75 autopsies and the spiral type in about 5 per cent of the cases.

DR. EVARTS GRAHAM: I would like to say a word in regard to biliary cirrhosis. It is unnecessary to have obstruction either of the common or hepatic duct to get rather extensive biliary cirrhosis.

In some work that I reported at the December meeting of the Society, I demonstrated that extensive pericholangitis might extend up into the liver associated with a cholecystitis, and in some of the cases in which this was demonstrated extensive cirrhotic changes had taken place without any obstruction whatever to the outflow of bile as evidenced by the clinical picture or anything found at the time of operation.

The course of events in these cases is probably an ascending infection of the nature of a pericholangitis which involves the periportal interlobular tissues and sometimes extends into the lobules with resulting changes of the parenchyma and substitution of connective tissue.

I had a case recently in which this was demonstrated to a marked extent, the patient giving a gall-bladder history extending over a period of fifteen years. There had never been any sign of jaundice present nor the least indication of obstruction to the hepatic or common duct; yet sections from the liver showed in every field of a low-power lens as many as eight or ten lobules, whereas normally in a microscopic field with a low power objective you can see only one or two lobules at most. The interlobular tissue was greatly increased in amount, and in every field of the microscope could be seen as many as eight or twelve finer branches of the bile-duct, which were surrounded by dense bands of connective tissue, and in some instances three or four times in diameter the thickness of the lumen of the small branch of the bile-duct itself. In this instance the gall-bladder was removed. A colon-like organism was obtained not only from the bile in the gall-bladder but also from the wall of the gall-bladder. It was found microscopically lying in clumps in the subepithelial tissue of the gall-bladder and was also obtained in culture from a piece of liver removed at the time of operation.

DR. BEVAN (closing): The suggestion made by Dr. Andrews and the specimen shown by Dr. Eisendrath are very important, and I would like to again emphasize the importance of following out the cystic duct until we know definitely just what we are dealing with at the time of operation, even up to the point — if there is any indication for it — of exposing the common duct.

In regard to Dr. Eisendrath's question as to whether I opened the common duct where there was no evidence demanding it, I do not. If I have a definite, typical case, with stones in the gall-bladder and cystic duct, and no evidence of stone in the common duct after careful palpation, I do not open the common duct. I do not think we should make a routine of opening the common duct in all these cases.

In regard to the reformation of a gall-bladder, we have had that happen in a case where we had removed the gall-bladder, and at the end of about 18 months we operated again and removed a gall-bladder as large as a thumb that had formed in the stump of the cystic duct. Evidently there is this possibility: In one of the long parallel cystic ducts we have a good deal of cystic duct tissue and if it does become dilated, we have quite a good-sized gall-bladder.

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD DECEMBER 21, 1917, DR. MARK T. GOLDSTINE, VICE-PRESIDENT

MEMBRANOUS CYSTITIS

DR. R. A. SCOTT: The history is that of an adult female, age 37. She has had three pregnancies, the first, 8 years ago; the second 6 years ago, both of which were normal; the third, and the one with which we have to deal in this report, was finished six months ago. Up until the eighth month, the urine was normal, but a specimen at that time, was packed with pus cells and the urine continued to contain a large amount of pus until the pregnancy was finished. There was no time during the ninth month at which the blood pressure was over 120 millimeters, and the urine was free from casts at all times.

She entered the Evanston Hospital, in labor, at full term, March 31, 1917. Her temperature was 99°; pulse 90; respirations 22. The urine showed a double plus albumin, a large number of pus-cells and cultures from urine an almost pure culture of pseudodiphtheria bacilli. After an eight hour labor, the baby was delivered with the application of low forceps. There was a spontaneous expulsion of the placenta, followed by a profuse hæmorrhage which was controlled by two injections of pituitrin.

The day following delivery, the patient's temperature rose to 100.4° and the pulse varied between 94 and 140, and she complained of severe shooting pains over the bladder. From the second day after delivery to the sixth day of her puerperium, her condition grew worse until she had all of the symptoms and findings of a bilateral parametritis; the lower abdomen rigid and tender, the temperature was 102°, pulse 140 and respirations 32. The white blood-cell count was 25,000. The head of the bed was elevated and M xx of ergot was given every four hours and fluids were taken in large amounts. The patient's condition improved rapidly and at her own urgent request, she was taken home in the ambulance on the fourteenth day after delivery, her temperature having been normal for the 24 hours preceding her departure from the hospital. A specimen of urine was examined on the day she left the hospital and thinking that the cystitis was perhaps a part of the general septic condition of the previous two weeks, and had not had time to clear up, I prescribed grs. x of urotropin to be taken every four hours, together with a large amount of water. At the end of a week I saw the patient again and she complained of frequent, painful urination. Her temperature was 99.6° and the urine contained many pus cells and a large number of shreds of tissue. She had difficulty in urinating and voided only a teaspoonful or two at a time. For the next three weeks I washed out her bladder every second day with a warm saturated boric acid solution, allowing the solution to enter the bladder slowly, by the gravity method. After the bladder was well irrigated each day, I put in 11 ounces of ¼ of 1 per cent protargol solution and allowed it to remain in the bladder. Instead of the cystitis abating, it grew worse, the shreds of tissue passed were larger and passed with a great deal of pain. The odor of the urine became so offensive that instead of using the boric solution, I used a weak solution of potassium permanganate. The third day after its use the patient had to extract shreds of tissue from her urethra before she was able to start the flow of urine. On the fourth day I found the patient in great pain from an acute retention of urine, which was caused by the presence in the urethra of a roll of grayish tissue. Intermingled with the gray were several strands of red tissue which on first sight looked like muscle fibers. Her temperature was 103.2°, pulse was 120, and respirations very rapid. I endeavored to extract the mass of tissue as had previously been attempted by the patient, but failed. I could not pass a rubber catheter but finally forced a glass catheter into the bladder and relieved most of the distention. Not knowing but what I had a prolapse of the urethra or part of the bladder, I called Dr. William R. Parkes. He failed to remove the mass and the patient was immediately taken to the hospital, and plans made to make a suprapubic incision and remove the mass from above. But after the patient was anæsthetized and well relaxed, the roll of tissue was removed from the urethra from below. The urethra was so dilated by the mass of tissue that one could easily insert the index finger into the bladder. The piece of membrane measured 8 by 15 centimeters. The laboratory described it as a piece of necrotic tissue with here and there, the outline of a blood-vessel. Cultures from it showed a variety of bacteria, with the bacillus coli, predominating. Cultures from the urine at this time showed a pseudodiphtheria bacillus.

The postoperative treatment of the case consisted in the insertion of a self-retaining catheter and for 7 days the bladder was irrigated with a saturated boric acid solution, every two hours. The returning fluid contained red blood-cells, pus-cells, and large shreds of tissue. On the eighth day after operation a cystoscopic examination was made by Dr. W. C. Danforth and large pieces of membrane were seen, hanging from the bladder wall and between these were areas of bladder wall which looked almost normal. For six days following this last examination, the bladder was irrigated, twice daily, with a 1:4000 silver nitrate solution. At the end of this period, the urine was free from tissue threads and the patient's condition had improved, generally.

She was able to retain her urine from one-half to an hour.

On June 12, 1917, 15 days after the extraction of the membrane, the patient left the hospital in apparently good condition. She had been home for two weeks, when she developed a phlebitis in the right leg. This condition cleared up after three weeks of rest in bed.

During the four months that have passed since the attack of phlebitis, I have examined, monthly, a specimen of the urine, and have found pus-cells in every one, but no tissue threads. The last specimen examined November 18 was much better. The patient has gained in weight and her general condition is good, but she cannot retain her urine for more than two hours. The bladder at this time, according to the patient's statement, holds about two-thirds of a teacup full.

The patient has refused another cystoscopic examination and any further medical treatment.

The cases thus far reported in this country of membranous cystitis of non-diphtheritic origin, are comparatively few in number. Rosenow has reported two cases, Curtis one, Townsend one, and Nelken of New Orleans one. The German literature of 9 or 10 years ago, reported a series of a few cases. Two of the cases mentioned above, were adult males and three were adult females.

Rosenow's cases had a sudden onset, with chills and fever and frequent painful and bloody urination. Curtis' case had a slow onset, having had discomfort for a year before applying for relief. The case of Townsend and Nelken also had slow onsets. In all of these cases, blood was a constant finding in the urine, as were pus cells and shreds of membrane.

In the case which I have reported, the findings just mentioned were present. It has an added interest in that it complicated a pregnancy and has run a most severe and protracted course.

DISCUSSION

DR. T. J. WATKINS: Relative to the etiology, I would like to ask Dr. Scott if he concluded that the traumatism of labor was the primary factor? It is possibly not generally understood how much traumatism the bladder may encounter during labor, when a knuckle of the bladder becomes engaged between the child's head and the pubes. The case which Dr. Curtis reported of psuedodiphtheritic infection of the bladder had calculi and these were probably important etiologic factors. It has been the rule, in cases requiring drainage, to make a vaginal cystotomy. The modern improved technique of abdominal cystotomy would seem now to be the better operation as better drainage would be obtained and closure by operation would not be necessary. Judging from the results obtained with the Dakin-Carrel solution, as recently reported by Dr. Moynihan, of Leeds, it would seem to be a most desirable remedy for cases of cystitis, with membranous exudates, such as Dr. Scott reported, as the solution mentioned readily cleanses the wound of necrotic tissue.

DR. ARTHUR H. CURTIS: The case of Dr. Rosenow's of which Dr. Scott spoke was operated on by Dr. J. Clarence Webster, who found membrane adherent to the mucosa of the bladder. Dr. Rosenow found colon bacilli and some pseudodiphtheria bacilli; the latter he thought caused the trouble because they were found in the wall of the bladder and they were agglutinated by the patient's serum, whereas the colon bacilli were not. The views of Townsend tend to substantiate the findings which Rosenow obtained. O'Neil, of Boston, reported 56 cases of diphtheritic cystitis and Houltain worked out 52 cases, making a total of 108. The diphtheritic and necrotic cases were not studied bacteriologically. In the few that have been worked up bacteriologically pseudodiphtheria bacilli were present as a basis for the trouble.

GLOMERULAR NEPHRITIS WITH SEVERE HÆMORRHAGE FROM ONE KIDNEY NECESSITATING NEPHRECTOMY

DR. W. C. DANFORTH: The case which I wish to report this evening is that of a man aged 44, married, janitor by occupation, colored.

I saw him through the courtesy of Dr. George F. Barry. He came into the hospital complaining of hæmaturia on May 12. About February 15 he noticed a very slight staining of blood in the urination. Frequency of urination was not increased at that time nor did it become more frequent as his trouble progressed.

At the time he entered the hospital the urine was bright red in color, discoloration showing in every specimen passed. And he was complaining of loss of strength which he had felt for the previous two or three weeks. Up to that time he had worked. He went to bed not because he was wholly unable to work but because of the visible and increasing hæmorrhage. No clots had ever been passed. He had complained of pain over the lower abdomen but no other discomfort.

Previous history. He had had the usual diseases of childhood. He sustained a sprain of the right hip a year ago which kept him in bed for six weeks He denied all venereal infection. He used no alcohol and was moderate in the use of tobacco. The family history was negative. The patient was a large heavily muscled man whose physical findings were wholly negative. Cystoscopic examination of the bladder was negative but upon observation of the left ureteral orifice a puff of blood could be seen coming from it at intervals. None was seen from the right side.

Catheterization of the ureters showed that the hæmorrhage was entirely confined to the left side. Urinary findings were negative except for large numbers of red cells and the presence of serum albumin which it was assumed came from the large amount of blood.

Examination of a morning sample for tubercle bacilli was negative. After this the entire output of

urine for 24 hours on several occasions was collected and the sediment from the entire amount was stained and examined for tubercle bacilli but none were found. Cultures from the urine obtained from the left kidney by ureteral catheter showed no growth at the end of 24 hours, but after several days a slowly growing organism appeared which after several weeks was still growing slowly and had not been fully identified by Dr. Gladys Henry Dick, pathologist of the Evanston Hospital.

Repeated X-ray examination showed no stone shadows. The outline, however, of the left kidney seemed a little larger than normal. Pyelography was not done. Phenolsulphophthalein test showed a total output of 45 per cent for 2 hours. Guinea pigs were inoculated with urine from the left kidney but no tuberculosis appeared. His temperature curve during his stay in the hospital of 14 days showed a rise on two occasions to 99° but no other elevations above normal. The pulse remained between 60 and 75.

As tuberculosis could not be demonstrated and as no stone shadow could be found, the diagnosis appeared to lie between that of a malignant tumor and a possible varix of the kind described by Hurry Fenwick. I was inclined to favor the diagnosis of malignancy and he was advised to have the kidney removed.

Previous to determining upon operation I injected into the pelvis of the bleeding kidney, 3 cubic centimeters of adrenalin. The bleeding entirely stopped immediately and did not recur for three days when it gradually began and within two days more was as bad as ever. This sudden stoppage impressed the patient greatly and he demanded that it be repeated. It was explained to him that it would undoubtedly benefit him only temporarily but at his earnest request it was repeated and the hæmorrhage stopped again and did not reappear for about a week. During this time the patient went home, promising to return if the hæmorrhage recurred. In about two weeks he returned expressing himself ready for operation.

Nephrectomy was immediately carried out. The kidney on removal was a little larger than normal but showed practically nothing on cut section except a little greater congestion than is normal. The specimen was very carefully gone over by Dr. Dick for a possible small area tuberculosis. Sections were made from all parts of the kidney. So many blocks were made for microscopic sections from various parts of the organ that I am unable to show the gross specimen as none remained.

Microscopic sections show the usual degenerative changes incident to a chronic nephritis. In addition the glomeruli show a fibrosis together with an area of albuminous exudate inside the capsule of the glomeruli. An occasional area of degeneration and infiltration with round cells is seen in the parenchyma.

This patient has been seen once recently. He is in excellent health, has gained in weight, and is at present actively carrying on his work.

DISCUSSION

DR. T. J. WATKINS: Did the history or findings indicate any focal infection?

DR. W. C. DANFORTH: No focal infection could be demonstrated in the case. The patient was gone over very carefully but nothing was found.

DR. ARTHUR H. CURTIS: A patient of Dr. Mellinger's whom I saw five or six years ago had unilateral hæmaturia with symptoms similar to those of Dr. Danforth's case. The patient was operated on by Dr. Halstead, who found what he thought was a varicosity of the veins of the pelvis of the kidney. Jones and McNider reported eleven cases; they concluded that the chief cause of these hæmaturias is a nephritis. In 8 cases they bisected the kidney from pole to pole and effected a cure without any further measures.

DR. J. CLARENCE WEBSTER: I had 3 cases in the Presbyterian Hospital in which hæmorrhage existed. The usual treatment was carried out. The first case was reported by Dr. Billings. One of the cases was bilateral and the others single. I decapsulated the kidneys and there was complete cure in two cases but no change in the third case. I kept track of the cases for two years or so but do not know what the further course was. It was the consensus of opinion of the medical men that decapsulation was the proper treatment.

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OUR COMMANDER-IN-CHIEF.

REPORT OF COMMITTEE ON MEDICINE AND SANITATION, ADVISORY COMMISSION, COUNCIL OF NATIONAL DEFENSE

FRANKLIN MARTIN, M.D., CHAIRMAN

IN reciting the accomplishments of the Committee on Medicine and Sanitation of the Council of National Defense since the organization of the committee in December, 1916, it is necessary to summarize briefly the activities of the Committee of American Physicians for Medical Preparedness during the eight months previous to that date. To this body is due much of the credit for the successful results attained by the Committee on Medicine and Sanitation, since it was in the earlier organization that many of the plans later prosecuted by the officially authorized governmental agency were initiated.

In April, 1916, the Committee of American Physicians for Medical Preparedness was created by the joint action of the presidents of the American Medical Association, the American Surgical Association, the Congress of American Physicians and Surgeons, the Clinical Congress of Surgeons of North America, and the American College of Surgeons. To this organization was delegated the duty of formulating plans whereby the civilian medical resources of the United States might be effectively co-ordinated for such purposes as might be required by the federal government. A chairman, secretary, and executive committee were selected, and state committees, consisting of nine leading medical men in each state of the union, appointed. To assist the state committees in their work, county committees were later organized, including in their membership medical representatives of the Army, Navy, Public Health Service, and American Red Cross, in addition to other prominent medical men resident in the respective counties.

On April 26, 1916, the executive committee of the Committee of American Physicians for Medical Preparedness tendered the services of the organization to the President of the United States. Existing federal laws did not permit the acceptance of gratuitous service by the government, and the offer was referred to the Secretary of War and the Secretary of the Navy. Upon the organization of the Advisory Commission of the Council of National Defense on December 6, 1916, the committee was requested to continue its activities under the direction of the Committee on Medicine and Sanitation of the Council.

During the spring and summer of 1916 a survey of hospitals and sanatoria had been made by the committee, with the result that information was obtained and turned over to the Committee on Medicine and Sanitation, upon its appointment, concerning the capacity of 1,700 of the leading institutions of the country, their facilities for caring for military and civilian needs, the personnel required for the successful conduct of the respective institutions, and other data of extreme importance.

The Committee on Medicine and Sanitation of the Council of National Defense immediately upon its appointment applied itself to the task of assisting in the expansion of the governmental medical departments to meet possible war needs. As a result, when war was declared early in April, considerable progress in co-ordinating the civilian and military medical resources of the country had been made.

GENERAL MEDICAL BOARD

On April 2, 1917, the chairman of the Committee on Medicine and Sanitation was authorized by the Secretary of War to appoint a General Medical Board to assist him in formulating plans for the mobilization of the civilian and military medical resources of the country. The following representative men were appointed to this board:

FRANKLIN MARTIN, M.D., member of advisory commission, Council of National Defense, chairman.
F. F. SIMPSON, M.D., chief of medical section, Council of National Defense, vice chairman.
WILLIAM C. GORGAS, Surgeon General, United States Army.
WILLIAM C. BRAISTED, Surgeon General, United States Navy.
RUPERT BLUE, Surgeon General, United States Public Health Service.
FREDERIC A. BESLEY, M.D.,* professor of surgery, Northwestern University Medical School, Chicago.
HERMANN M. BIGGS, M.D., state commissioner of health, New York City.
GEORGE E. BREWER, M.D.,* professor of surgery, Columbia University, New York City.
JOHN YOUNG BROWN, M.D., professor of surgery, University of St. Louis, St. Louis.
GEORGE W. CRILE, M.D.,* professor of surgery, Western Reserve University, Cleveland.
EDWARD P. DAVIS, M.D., professor of obstetrics, Jefferson Medical College, Philadelphia.
JOHN M. T. FINNEY, M.D.,* professor of clinical surgery, Johns Hopkins University, Baltimore.
SIMON FLEXNER, M.D., director, Rockefeller Institute for Medical Research, New York City.
JOSEPH M. FLINT, M.D.,* professor of surgery, Yale University, New Haven, Conn.
THOMAS W. HUNTINGTON, M.D., professor of surgery, University of California, San Francisco.
THEODORE JANEWAY, M.D., professor of medicine, Johns Hopkins University, Baltimore.
Col. JEFFERSON R. KEAN,* director of military relief, American Red Cross.

* In active service overseas.

EDWARD C. KIRK, D.D.S., dean of dental department, University of Pennsylvania, Philadelphia.
EDWARD MARTIN, M.D., professor of surgery, University of Pennsylvania, Philadelphia.
CHARLES H. MAYO, M.D., president, American Medical Association, Rochester, Minn.
WILLIAM J. MAYO, M.D., president, American College of Surgeons, Rochester, Minn.
STUART MCGUIRE, M.D., dean and professor of surgery, Medical College of Virginia, Richmond.
CHARLES H. PECK, M.D.,* professor of surgery, Columbia University, New York City.
EARLE PHELPS, sanitary engineer, Washington.
HUBERT A. ROYSTER, M.D., secretary, Southern Surgical Association, Raleigh, N. C.
GEORGE H. SIMMONS, M.D., editor, Journal of American Medical Association, Chicago.
WINFORD H. SMITH, M.D., superintendent, Johns Hopkins Hospital, Baltimore.
RICHARD P. STRONG, M.D.,* professor of tropical medicine, Harvard Medical School, Boston.
VICTOR C. VAUGHAN, M.D., dean of University of Michigan Medical School, Ann Arbor, Mich.
GEORGE WALKER, M.D.,* associate in surgery, Johns Hopkins University, Baltimore.
WILLIAM H. WELCH, M.D., professor of pathology, Johns Hopkins University, Baltimore.
W. C. WOODWARD, M.D., health officer of the District of Columbia, Washington, D. C.

Of this original group many have been called into active military service abroad so that it has been found necessary to add to the membership of the board from time to time and the following are now included among the members:

JOHN FAIRBAIRN BINNIE, M.D., recorder, American Surgical Association, Kansas City, Mo.
JOSEPH C. BLOODGOOD, M.D., associate professor of surgery, Johns Hopkins University, Baltimore.
JAMES BORDLEY, JR., M.D., surgeon in charge, South Baltimore Eye Hospital, Baltimore.
ELLIOTT G. BRACKETT, M.D., assistant professor of orthopedic surgery, Harvard Medical School, Boston.
ALEXIS CARREL, M.D.,* member of staff, Rockefeller Institute for Medical Research, New York City.
JOHN G. CLARK, M.D., professor of gynecology, University of Pennsylvania, Philadelphia.
FREDERIC J. COTTON, M.D., associate in surgery, Harvard Medical School, Boston,
ALEXANDER R. CRAIG, M.D., secretary, American Medical Association, Chicago.
THOMAS S. CULLEN, M.B., vice president, Southern Surgical Association, Baltimore.
KATHERINE B. DAVIS, M.D., executive secretary, Bureau of Social Hygiene, Rockefeller Foundation, New York City.
JOHN B. DEAVER, M.D., professor of practice of surgery, University of Pennsylvania, Philadelphia.
ROBERT L. DICKINSON, M.D., first vice president, American Gynecological Society, Brooklyn.
PHILIP SCHUYLER DOANE, M.D., director of health and sanitation, United States Shipping Board, Chicago.
JOSEPH RILUS EASTMAN, M.D., president, Western Surgical Association, Indianapolis, Ind.
WILLIAM A. EVANS, M.D., president, American Public Health Association, Chicago.
DUNCAN EVE, SR., M.D., president, Southern Medical Association, Nashville, Tenn.
JOEL E. GOLDTHWAIT, M.D.,* lecturer on orthopedics, Harvard Medical School, Boston.
S. S. GOLDWATER, M.D., superintendent, Mount Sinai Hospital, New York City.
CARY T. GRAYSON, rear admiral, United States Navy, Washington.
WILLIAM D. HAGGARD, M.D., professor of surgery, Vanderbilt University, Nashville, Tenn.
S. MCC. HAMILL, M.D., professor of pediatrics, University of Pennsylvania, Philadelphia.
HOBART AMORY HARE, M.D., professor of therapeutics, materia medica, and diagnosis, Jefferson Medical College, Philadelphia.
MALCOLM L. HARRIS, M.D., secretary, board of trustees, American Medical Association, Chicago.
SEALE HARRIS, M.D., secretary, Southern Medical Association, Birmingham, Ala.
JABEZ JACKSON, M.D., Christian Church Hospital, Kansas City, Mo.
HENRY D. JUMP, M.D., assistant physician, Philadelphia General Hospital, Philadelphia.
CHARLES E. KAHLKE, M.D., professor of surgery, Hahnemann Medical College, Chicago.
ALLEN B. KANAVEL, M.D., associate professor of surgery, Northwestern University Medical School, Chicago.
JOHN H. LANDIS, M.D., health commissioner, Cincinnati, Ohio.
JOHN A. LICHTY, M.D., professor of medicine, University of Pittsburgh, Pittsburgh.
W. H. G. LOGAN, M.D., D.D.S., president, National Dental Association, Chicago.
FRED BATES LUND, M.D., lecturer on surgery, Harvard Medical School, Boston.
JOHN D. MCLEAN, M.D., member of staff, Rush Hospital, Philadelphia.
C. JEFF MILLER, M.D., professor of obstetrics and clinical gynecology, Tulane University, New Orleans.
ROSALIE SLAUGHTER MORTON, M.D., chairman, American Women's Hospitals, New York City.
MISS M. ADELAIDE NUTTING, professor of nursing and health, Teachers' College, Columbia University, New York City.
ALBERT J. OCHSNER, M.D., professor of surgery, University of Illinois, Chicago.
CHARLES B. PENROSE, M.D., professor of gynecology, University of Pennsylvania, Philadelphia.
EMMET RIXFORD, M.D., professor of surgery, Stanford University, San Francisco.
STERLING RUFFIN, M.D., professor of medicine, George Washington University, Washington.

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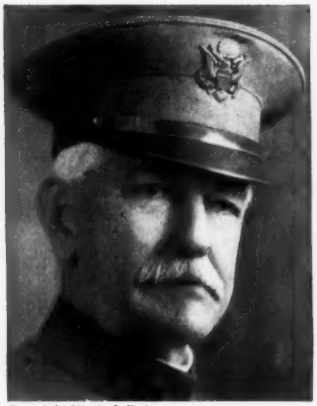
COUNCIL OF NATIONAL DEFENSE AND ADVISORY COMMISSION.

Seated, left to right — DAVID F. HOUSTON, Secretary of Agriculture; JOSEPHUS DANIELS, Secretary of the Navy; NEWTON D. BAKER, Secretary of War (Chairman of the Council); FRANKLIN K. LANE, Secretary of the Interior; WILLIAM B. WILSON, Secretary of Labor.

Standing, left to right — GROSVENOR B. CLARKSON, Secretary of Council and Commission; JULIUS ROSENWALD; BERNARD M. BARUCH; DANIEL WILLARD, Chairman of Commission; FRANKLIN MARTIN, M.D.; HOLLIS GODFREY, Ph.D.; HOWARD E. COFFIN; WALTER S. GIFFORD, Director of Council and Commission.



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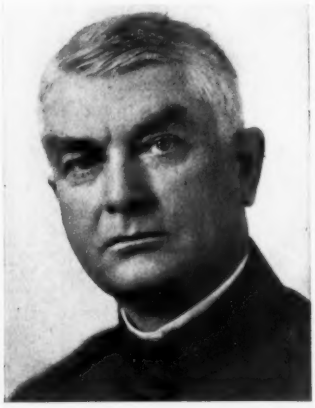

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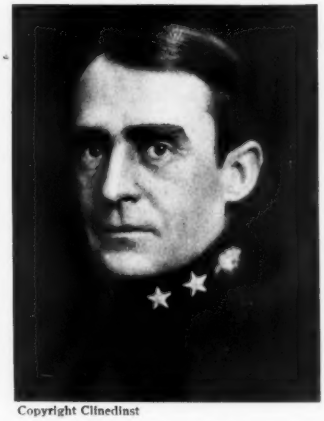

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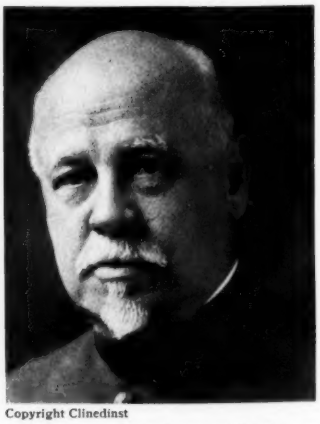

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EXECUTIVE COMMITTEE OF THE GENERAL MEDICAL BOARD

GEORGE E. DE SCHWEINITZ, M.D., professor of ophthalmology, University of Pennsylvania, Philadelphia.
WILLIAM F. SNOW, M.D., professor of public health, Stanford University, Cal., New York City, (Secretary General Medical Board).
J. BENTLEY SQUIER, M.D., professor of urology and genito-urinary surgery, Columbia University, New York City.
GEORGE DAVID STEWART, M.D., professor of surgery, University and Bellevue Hospital Medical College, New York City.
WILLIAM S. THAYER, M.D.,* president, Congress of American Physicians and Surgeons, Baltimore.
WILLIAM B. VAN LENNEP, M.D., professor of surgery, Hahnemann Medical College, Philadelphia.
FLORENCE N. WARD, M.D., chief surgeon, Florence N. Ward Sanatorium, San Francisco.
RAY L. WILBUR, M.D., president, Stanford University, San Francisco.
HUBERT WORK, M.D., chairman, House of Delegates, American Medical Association, Pueblo, Colo.

HONORARY MEMBERS

COL. C. U. DERCLE, Medical Department, French Army, Paris, France.
LIEUT. GEN. THOMAS H. GOODWIN, director general, British Army Medical Service, London, England.
COL. CLAUDE K. MORGAN, British Army Medical Service, London, England.
MR. JULIUS ROSENWALD, member of advisory commission, Council of National Defense, Chicago.

At the first meeting of the General Medical Board, held on April 9, 1917, the following committees and chairmen were appointed:

Executive — FRANKLIN MARTIN, M.D.
States activities and examinations — WILLIAM J. MAYO, M.D.
Legislation — VICTOR C. VAUGHAN, M.D.
Hygiene and sanitation — SURGEON GENERAL RUPERT BLUE.
Research — VICTOR C. VAUGHAN, M.D.
Dentistry — EDWARD C. KIRK, D.D.S.
Medical schools — JOSEPH M. FLINT, M.D.
Publicity — GEORGE H. SIMMONS, M.D.
Hospitals — WINFORD H. SMITH, M.D.

During the following months new committees were appointed and changes made in the personnel of the original committees as follows:

Child welfare — SAMUEL MCC. HAMMILL, M.D.
Civilian co-operation in combating venereal diseases — WILLIAM F. SNOW, M.D.
Dentistry — W. H. G. LOGAN, M.D., D.D.S.
Editorial — EDWARD MARTIN, M.D.
Industrial medicine and surgery — JOSEPH SCHERESCHEWSKY, M.D.
Medical advisory boards — EDWARD MARTIN, M.D.
Nursing — MISS M. ADELAIDE NUTTING.
States activities — EDWARD MARTIN, M.D.
Surgery — CHARLES H. MAYO, M.D.
Women physicians — ROSALIE SLAUGHTER MORTON, M.D.
Volunteer Medical Service Corps — EDWARD P. DAVIS, M.D.

THE EXECUTIVE COMMITTEE

Such medical problems as develop from the activities of its various committees are considered at the monthly meetings of the board, and referred for action, if deemed advisable, to the executive committee, which includes, Surgeon General William C. Gorgas; Surgeon General William C. Braisted; Surgeon General Rupert Blue; Rear Admiral Cary T. Grayson, Franklin Martin, M.D., chairman; F. F. Simpson, M.D., vice chairman; William J. Mayo, M.D.; Victor C. Vaughan, M.D.; and William H. Welch, M.D. If the recommendations of a committee are approved by the executive committee, they are laid before the Advisory Commission, or the Council of National Defense, or both, by the chairman. If endorsed, the recommendations for final working out are referred back to the General Medical Board, or distributed in the way of information to those in authority in the bureaus concerned.

There is close co-operation between the General Medical Board and the government departments and bureaus which have to do with medicine, surgery, and sanitation. At each monthly meeting reports are presented by representatives of the Surgeons General of the Army, Navy and Public Health Service and the Red Cross.

ACTIVITIES OF THE GENERAL MEDICAL BOARD

At the first meeting the following recommendations were considered and unanimously approved, the chairman directing the various committees to proceed in accordance with the instructions of the board:

1. Request of the American Red Cross, that the legislative committee endeavor to secure through the enactment of proper legislation a place in Washington, D. C., for the storage of medical supplies to be furnished by the American Red Cross to the Army.

2. Survey of available supply of medical men for military and civilian needs.

3. Immediate assignment by the Surgeon General of two medical reserve officers in each state to make personal canvass of their respective states for the purpose of increasing the enrollment of men in the Medical Reserve Corps.

4. Co-operation of the committee on research with the National Research Council in its activities.

5. Conservation of the source of supply of medical men—namely, third and fourth year medical students—by recommending that they complete their medical education in order that the government might receive the benefit of their trained services upon graduation.

6. Plan of the committee on dentistry to increase the personnel of the Dental Corps of the Army and Navy and to mobilize the dental facilities of the country for military needs.

7. Classification of the staffs of hospitals according to availability for immediate military service and institutional needs.

Immediately following this meeting the quarters of the committee were enlarged, the office force increased, and machinery put in motion for carrying out the plans outlined by the General Medical Board. Committee chairmen report at the headquarters of the Council of National Defense at regular intervals, many of them devoting their entire time to governmental activities.

Immediately upon the arrival of the British and French commissions in this country, in April, 1917, the chairman communicated with Mr. Balfour and members of the Joffre Commission concerning the need for medical men and supplies in the war zone. As a result of this conference he recommended to the Surgeon General's office that ten base hospitals, with personnel sufficient for 1,000 beds each, and 2,000 ambulances be sent to France and attached to the French and British forces. Within a month base hospitals were on the other side in the service of the allies.

On June 11, 1917, the executive committee of the General Medical Board appointed a committee to investigate plans for contonments and location of camp sites. As a result of this committee's investigations, a recommendation was made to the Secretary of War on June 13 that a regulation be made and enforced that the selection of camp sites and all plans for the construction, repair, and location of buildings, water supply, drainage, sewage disposal, and other matters relating to hygiene and sanitation be submitted to the Surgeon General or his representative for approval before work is started. The Secretary approved the recommendation, and the regulation was made.

In addition to frequent committee meetings, many sessions of the General Medical Board and group conferences under its auspices have been held, most of the last mentioned having to do with enrollment of officers for the medical service of the Army and Navy. Some of these were:

January 6, 1917 — Meeting of deans of medical schools to discuss military medical training of students. Attended by 87 representatives.

April 9, 1917, to January 13, 1918, inclusive — Eleven regular meetings of General Medical Board. Average attendance, 50.

April 28, 1917 — Meeting of deans of medical schools to discuss continuous teaching and danger of disorganizing medical schools and civilian hospitals. Forty-six representatives present.

May 12, 1917 — Conference of committee on dentistry with deans of dental colleges and dental examining boards, to discuss co-ordination of activities. Thirty-six deans and 20 representatives of state examining boards attended.

July 18, 1917 — Meeting of deans of dental schools to discuss enlistment of students in Enlisted Medical Reserve Corps and their assignment to the inactive list. Fifty deans attended.

July 27, 1917 — Meeting of homeopathic physicians, who agreed to furnish 1,000 physicians for the Army. Attended by 150 representatives.

August 12, 1917 — Special meeting of General Medical Board at Rockefeller Institute for Medical Research, New York City. Attended by 46 invited guests and 31 members of General Medical Board.

October 21, 1917 — Special meeting of General Medical Board in Chicago during week of meeting of Clinical Congress of Surgeons of North America. Attended by 31 members of General Medical Board and representatives of the various state committees.

Week of October 22, 1917 — Conference of state committees in Chicago, to speed up enrollment in the Medical Reserve Corps. Representatives from 47 states present.

March 10, 1918 — Special meeting of General Medical Board at Camp Greenleaf, Fort Oglethorpe, Georgia. Attended by 16 members of General Medical Board and about 800 of the doctors in training at Camp Greenleaf.

MEDICAL RESERVE CORPS

In the late fall of 1916 the committee was requested by the Surgeon General of the Army to assist that department in arousing the interest of the civilian medical profession in the Medical Reserve Corps with a view to increasing enrollments in the corps to meet possible war needs. The membership of the corps at that time was approximately 1,800, including men beyond military age and those who were physically ineligible for active field duty. Through its state and county committees the Committee on Medicine and Sanitation immediately took steps to classify the medical profession according to availability for military service and community needs. As a result of this classification 20,000 selected men were communicated with by the committee urging their prompt enrollment in the Medical Reserve Corps.

This was supplemented by instructions to the state and county committees to hold frequent patriotic meetings and by personal interviews with prospective candidates to concentrate every effort toward securing enrollments. The work of the state and county committees along this line has been accompanied by correspondence from the committee in Washington. National, state, and local medical societies have been requested to devote some portion of the programs of their regular meetings to the needs of the Medical Reserve Corps, and these meetings have been addressed by representatives from the Council of National Defense.

In the summer of 1917, 60,000 application blanks for enrollment in the Reserve Corps were printed and distributed by the committee to prospective candidates throughout the country. Medical journals were requested to print application blanks

as part of their publications and to give space in their editorial columns to the need for men in the Medical Reserve Corps. Candidates for appointment to the Reserve Corps who were rejected for slight physical defects were requested to have these remedied in order that, if necessary, they might later be available for military duty.

Enrollments in the Medical Reserve Corps have been increased from 1,800 at the beginning of the war in April, 1917, to over 21,000 at the present time. Of this number more than 15,000 are on active duty.

To aid the Navy in securing desirable young men for its Medical Corps a conference of deans of medical schools was called by the chairman in December, 1916. To this conference in Washington came representatives of every reputable medical school in the country, and the recommendations of the conference — viz., that senior medical students enroll in the Medical Corps of the Navy, and that a short course of medical-military instruction be included in the curricula of the various institutions — were adopted. Officers of the regular and reserve medical corps were detailed as instructors in military medicine at medical schools and in June, 1917, the Medical Department of the Navy was substantially enlarged by the enrollment of the most desirable of the medical graduates of that year.

About 250,000 letters have been sent out, of which 143,432 were circular letters of many kinds concerning enrollments in the medical services of the Army and Navy sent to state and county committees and to miscellaneous groups.

Letters were sent to pharmacists, sanitary engineers, and ambulance drivers advising them as to where they could be of most service in the Army. Letters were also sent to manufacturers of dental, surgical, and orthopedic apparatus asking details regarding special qualifications of employees drafted from their plants, with a view to utilizing the skill of such men to best advantage in camp or hospital or in factories turning out supplies needed by the government.

In March, 1917, fifty medical societies were requested to furnish lists of their members fitted to perform special work for the government.

Early in 1917 many medical men, who had returned after service and observation with the allied armies, were requested to furnish the committee with information as to conditions in the medical services abroad. This mass of information was carefully summarized and recorded for reference purposes, with a view to its possible application to the United States medical services.

STANDARDIZATION OF MEDICAL AND SURGICAL SUPPLIES

The Committee on Standardization was authorized February 2, 1917, under the chairmanship of Dr. F. F. Simpson, for the purpose of standardizing essential medical and surgical supplies and equipment, to increase speed and reduce cost of production. This committee included in its membership, representatives of the Army, Navy, American Red Cross, and Public Health Service. Various subcommittees representing the medical specialties and manufacturers were appointed.

Frequent conferences of the committee and its subcommittees were held throughout the spring and summer of 1917 for the purpose of studying by what means production might be speeded up and demand curtailed. With the hearty co-operation of the manufacturers, who gave freely of their time and willingly adapted their facilities to the government needs, the result has been a substantial increase in the production of staple articles sufficient to meet the enormously increased requirements of the Army and Navy. Four catalogues of staple medical and surgical instruments and supplies were prepared and issued by this committee for the use of the Army, Navy, and American Red Cross: Part I, Surgical Instruments; Part II, Medicines, Antiseptics, Disinfectants, etc.; Part III, Laboratory Supplies; and Part IV, X-ray Apparatus and Supplies.

This division conducted an investigation of medicinal products for the offices of the Surgeon General of the Army and of the Bureau of Medicine and Surgery of the Navy. As there are certain elements usable both for medicinal purposes and in the manufacture of explosives, careful investigation was made into the requirements for the release of these elements, with a view to preventing their finding their way into the hands of the enemy. In co-operation with other departments inquiries were made as to the reasons for the shortage in important drugs, and in many instances these conditions were relieved. Through the recommendation of the use of paper, tin, and composition receptacles the shortage in glass containers was in large part met.

The Fuel Administration was informed as to the coal requirements of drug manufacturers. Similarly the Food Administration was advised that many articles coming under its control are required in medicine.

Drug and chemical manufacturers and dealers were informed as to the requirements for licenses in handling explosives or as to the necessity for licenses in exporting substances which are on the conservation list. The removal from the freight-embargo list of articles demanding prompt transportation was secured.

RECONSTRUCTION OF MAIMED AND CRIPPLED

On June 22, 1917, a conference, called by the chairman of the General Medical Board, was held to consider the matter of reconstruction of wounded soldiers and sailors and their re-education for return to civil life upon discharge from the Army and Navy.

As a result of this meeting the Committee on Re-education and Rehabilitation was appointed. This body met frequently, and as a result of its recommendations the chairman of the General Medi-

cal Board presented to the Secretary of War a plan for the formation of a reconstruction board, upon which would be represented the following departments and interests: United States Army, United States Navy, United States Public Health Service, American Red Cross, Council of National Defense, hospitals and laboratories, medicine and surgery, vocational education, labor and industry.

The Secretary of War instructed the Surgeon General to call a conference in Washington on January 14, 1918, to which representatives of the departments interested were invited for the purpose of formulating a definite plan of action. A bill was drafted which is now before Congress, providing for the vocational rehabilitation and return to civil employment of disabled soldiers and sailors.

REPORTS OF COMMITTEES

CHILD WELFARE

At a preliminary conference in June, 1917, attended by twenty-one representatives of various organizations, educational institutions, and governmental bureaus interested in child welfare, the following resolution was adopted:

We urge the Council of National Defense to ascertain whether there is need among the allied nations for maternity care and infant and child welfare work that can properly be performed by Americans, and if this be the case, that the council confer with suitable persons or organizations with the view to rendering such service.

Among those who attended this conference were William P. Lucas, M.D., professor of pediatrics in the University of California, and Mrs. William Putnam Lowell of Boston, vice-president of the American Association for the Study and Prevention of Infant Mortality. Dr. Lucas had been engaged in infant welfare work in Belgium, and in August he was appointed head of a group of specialists in child welfare who went to France under the auspices of the Red Cross, the expedition being financed by Mrs. Lowell.

Other suggestions developing from this conference led to the formation, in the late fall, of the committee on child welfare of the General Medical Board. This committee has prepared and issued to the states, through the state councils section and the woman's committee of the Council of National Defense, programs covering the problems of the child up to the school age, and is preparing a program covering the problems of the child of the school age.

In conjunction with the Committee for Civilian Co-operation in Combating Venereal Diseases and the Committee on Industrial Medicine and Surgery, it has submitted to the General Medical Board resolutions recommending that the board ask the faculties of medical schools to have the industrial diseases, prenatal and obstetrical care, infant welfare, and the venereal diseases made an integral part of the curriculum of the various medical schools, and that members of the faculties avail themselves of every opportunity to impress the importance of these problems from the public health standpoint upon the medical profession as well as the public at large.

It has subcommittees on:

1. The best graphic methods of teaching child welfare.
2. Food values necessary to children of various ages.
3. Publicity.
4. Best procedure to recommend to the states in respect to the midwife question in the present war emergency.
5. To consider the advisability of recommending the investigation of institutions for the care of children and the best means of making such investigations.

CIVILIAN CO-OPERATION IN COMBATING VENEREAL DISEASES

The original committee having this work in hand formulated resolutions and presented arguments at hearings arranged by the chairman of the Committee on Medicine and Sanitation before the Advisory Commission and Council. These hearings resulted in the adoption of the government's policy. The preparatory work included the presentation of arguments before congressmen and committees as to the laws against prostitution and alcohol, and the original committee also initiated an educational campaign for medical support of the social hygiene program.

The importance of the work quickly led to the appointment of the Subcommittee for Civilian Co-operation in Combating Veneral Diseases as a subsidiary of the Committee on Hygiene and Sanitation. This subcommittee continued the dissemination of literature and continued to develop correspondence. Quantities of the circulars, "Do Your Bit To Keep Him Fit," and "Safeguarding Our Soldiers from Venereal Diseases," were distributed; 28,000 circular letters were sent to selected individuals in nearly 600 communities in the vicinity of Army camps, and the active co-operation of about 1,000 individuals offering to serve was enlisted through personal correspondence.

With the enlargement of its activities and with the increasing recognition of its vital importance, the subcommittee was made a full committee of the General Medical Board. The committee developed joint conferences of medical and lay citizens with officials to discuss plans for venereal disease clinics

and law enforcement measures in fifty cities. Advertisers and press association committees were organized for advice and co-operation in developing public opinion favorable to the social hygiene program. The governors of all the states were communicated with, by wire and letter, urging recognition of the emergency and drastic action in dealing with venereal diseases. A list of eight measures essential to a successful campaign was formulated and sent to state boards of health. State pharmaceutical associations and boards of pharmacy were appealed to in an effort to eliminate advertising and sale of venereal disease nostrums. The mayors of 1,000 cities and towns, especially in the vicinity of Army camps, were also asked to enforce existing laws and enact necessary legislation. Through trips arranged for health officers and qualified officials thirty states were reached and boards of health greatly stimulated to more vigorous work. Volunteer speakers have been furnished in co-operation with representatives in civilian communities. Negotiations have been opened with the industrial service sections of the Emergency Fleet Corporation and the Ordnance Department for lectures in shipyards and munitions plants. A syllabus and other data have been furnished the state councils section of the Council of National Defense for lectures to drafted men in county meetings. Editors of health bulletins and labor journals are being kept informed regarding the progress of the campaign against venereal diseases, and editorials have been prepared for health, medical, and social hygiene publications.

Partially as a result of the committee's correspondence with state boards of health throughout the country, 32 states have adopted laws or regulations requiring the reporting of venereal diseases; 11 states have organized bureaus or divisions of venereal diseases in their health departments; at least 15 states provide free laboratory diagnosis; at least 6 states provide arsphenamin free or at low cost; 16 states are engaged in educational work; only 2 states have given no indications of activity in venereal disease campaign.

Partially as a result of the letters sent to mayors of 1,000 cities and towns, 49 of these cities have made provision for the isolation and treatment of persons infected with venereal diseases; 51 of these cities and towns have measures requiring the reporting of venereal diseases; 43 of these cities and towns have venereal disease clinics or advisory stations; 18 of these cities and towns have educational work under way; 60 additional cities and towns have educational work under way; and only 19 cities and towns are classified as complacent.

DENTISTRY

At the time the United States declared a state of war to exist between this country and Germany, the total number of dental officers was 58 — 18 captains and 40 first lieutenants — a sufficient number to care for an organization of fifty-odd thousand men. Probably less than 30 of these were stationed in the United States, and they were widely scattered. The law at this time only permitted the commissioning of Dental Reserve Corps officers in the grade of first lieutenant, and there was not a nucleus of a reserve corps to start with, as in the case of the medical service.

In the past year the number of dental officers has increased from 58 in the Dental Corps of the regular army to 209, in the National Guard to 259, and in the Dental Reserve Corps to 5,196 — or a sufficient number to supply the quota permitted by law for an army of 5,664,000 men. These officers as a result of the dental law enacted on October 6, 1917, are distributed in the same grades and percentages within the grades as are allowed for officers of the Medical Corps of the regular army and National Guard and of the Medical Reserve Corps. The commission of first lieutenant was tendered 5,467 dentists, and 95.1 per cent accepted — all but 271.

In the rapid development of the dental service, all credit must be given the patriotism of the members of the dental profession, the various preliminary dental examining boards, dental faculties, dental manufacturers, and officers and members of the Preparedness League of American Dentists, an organization which a year ago had a membership of 5,000, but today has about 15,000 members, who have paid the membership fee and declared their willingness to render gratuitous service at least one hour a day, when called upon, to assist in making dentally fit the selected man, after he has been certified to by his local board and previous to his induction into military service.

The official record shows that 166,000 gratuitous dental operations have been performed by the members of this organization. This organization has been largely responsible for the three dental motor-car ambulances that have been presented to the Surgeon General of the Army. More efficient dental service is expected to result from the fact that dental inspectors are now regularly visiting the cantonments and camps.

The Committee has co-operated closely with the deans of dental schools. At a conference held May 12, 1917, attended by deans of thirty-six dental colleges and twenty representatives of state examining boards, with this committee, many details designed to co-ordinate dental activities were agreed upon. At another conference, July 18, fifty deans discussed with this committee the enlistment of dental students in the Enlisted Medical Reserve Corps and their assignment to the inactive list.

Upon the recommendation of this committee, a survey of dental and oral hospital physicians was made. An investigation was initiated as to the relationship of trench-mouth disease and oral and general disease. In co-operation with dental manufacturers, dental instruments and supplies were standardized.

Military instruction was included in the curricula of dental colleges, and special training of applicants for enrollment in the Dental Reserve Corps initiated. Improved courses in the Army and Navy medical schools for Army and Navy dental surgeons were recommended.

A school of instruction for dental officers started March 15, 1918, at Camp Greenleaf, Fort Oglethorpe, Ga., with Lieut. Col. Snapp, Dental Corps, as senior instructor. Eighty-five dental officers and enlisted personnel are assigned each month to take the two months' course. The first month is given over to 180 hours of general military instruction and training, and the second to 70 hours' special military training, and 110 hours devoted to professional subjects that have a definite relation to general practice of dentistry as it should be conducted in the Army.

The United States is the only country giving such extensive training in military and professional subjects to dentists, and this nation has a greater number of dental officers subject to military call than all other nations combined, represented by the term "the allies."

EDITORIAL

With the idea of being of immediate and direct benefit to the largely increased numbers of medical officers who had not had military medical experience, and to enable them the better to conserve the health and lives of the fighting men of the United States, the General Medical Board authorized this committee to proceed with the publication, in pocket-manual form, of textbooks epitomizing the surgical and medical experience acquired in the war, and written by men specially qualified by training and by war experience.

Six "Medical and Surgical War Manuals, approved by the War Department, the Surgeon General, and the Council of National Defense," have been published, as follows:

1. "Sanitation for Medical Officers," by Edward B. Vedder, lieutenant colonel, M. C., U. S. A.
2. "Notes for Army Medical Officers," by T. H. Goodwin, lieutenant colonel, R. A. M. C.
3. "Military Ophthalmic Surgery," by Allen Greenwood, major, M. R. C.; G. E. de Schweinitz, major, M. R. C.; and Walter R. Parker, major, M. R. C.
4. "Military Orthopedic Surgery," by the Orthopedic Council.
5. "Lessons from the Enemy," by John R. McDill, major, M. R. C.
6. "Laboratory Methods of the United States Army," compiled by the Division of Infectious Diseases and Laboratories, Office of the Surgeon General, United States Army.

In addition to the above list a seventh manual, entitled "Surgery of the Zone of Advance," by George de Tarnowsky, major, M. R. C., is now ready for publication.

HOSPITALS

The committee on hospitals recommended to the general hospitals of the country the reorganization of their staffs in order to release as many as possible of their members for Army and Navy service. Lists were requested of those necessary for the efficient operation of the institutions, and lists of those available for service were forwarded to the committee, each person on these latter lists being requested to apply for appointment in the Medical Department of the Army.

The hospitals of the country were classified as to size, convenience to railroad, equipment, facilities for expansion and equipment for handling special work. Tuberculosis sanatoria and dispensaries were inventoried, and a survey made as to hospitals for convalescents. The matter of portable hospitals was gone into, and the purchase of a limited number of this form of hospital recommended to the Surgeon General of the Army. Offers of private houses and other large buildings, tendered to the Surgeon General for use as military hospitals, were classified and tabulated for use by the Surgeon General's office. Hospitals were urged to acquire gradually reserve stocks with a view to future expansion.

HYGIENE AND SANITATION

Realizing the relation of the alcohol problem to venereal disease, the committee on hygiene and sanitation, in April, 1917, recommended to the War and Navy Departments that the zones around camps and cantonments be placed under military control in order to protect the troops from venereal infections, and the action of the War and Navy Departments in prohibiting the sale of alcoholic beverages within the camps and extra-cantonment zones was emphatically indorsed. A sub-committee on venereal diseases was appointed, which has been of material assistance to the Surgeon General's Office of the Army and to the Commissions on Training Camp Activities. The work of this subcommittee has expanded, and it has become the general committee, now called the Committee for Civilian Co-operation in Combating Venereal Diseases. Its activities are detailed under that head. Its work has been of tremendous importance to the welfare of the Army and Navy and to the civilian population.

The committee on hygiene and sanitation also has subcommittees on drug addiction, alcoholic control, public health nursing, tuberculosis and health statistics. Much valuable information has been assembled, and many valuable recommendations as sanitary measures have been made, these subcommittees at all times co-operating with the Army, Navy, Public Health Service, American Red Cross, and civilian health agencies.

The committee indorsed the enactment of legislation to establish a reserve corps for the United States Public Health Service.

INDUSTRIAL MEDICINE AND SURGERY

On January 28, 1918, a conference was called by the chairman of the General Medical Board to consider the medical care and sanitation of industrial workers. As a result of this conference the appointment of a committee, including in its membership representatives of the Departments of Agriculture, Commerce, Interior, Labor, and Public Health Service, and of industry, manufacturers, and the medical profession, was recommended. This committee was approved by the Council of National Defense and instructed to proceed with the prosecution of its plan for the medical care of industrial workers. The work of the committee promises to be of signal importance in view of the increased drain on the industrial resources of the country as a result of excessive war-time production.

The pressure of production in factories, on farms, and in mines has produced health problems and social problems which, under direction of a government agency, must be solved by the medical profession, by industry, and by labor. The sanitation of industries, proper food and housing, and the teaching of thrift are war equations. The wage question is relatively in abeyance.

The committee recognizes that the state of war makes it imperative: (1) to provide against unnecessary human waste in industry and society during the war; (2) to offset the drain on industry of man power caused by the raising of military forces; (3) to meet the need for greatly increased production; (4) to avoid preventable deaths and disabilities from accident and disease; (5) to restore to full producing power in the shortest possible time sick and injured workers; (6) to increase output by keeping workers in good health; (7) to provide healthful places in which to work; (8) to provide healthful homes and communities in which to live; (9) to meet shortage of medical service induced by military needs.

The Committee on Railway Surgeons has been made a subcommittee of this body and will work in co-operation with it. Through questionnaires sent to the railway chief surgeons, the railway surgeons were classified as to availability for military duty or necessity for remaining at home.

LEGISLATION

The Committee on Legislation interested itself at the outset in the safeguarding of the troops from vice in the zone around camps and cantonments. Section 13 of the Army bill was the result. The committee drafted this section in an all-day Sunday session, in the spring of 1917. It was presented to the executive committee of the General Medical Board on the following day and indorsed. Two days later it was presented to the Council of National Defense and approved, and ten days after the first rough draft was made it was enacted into law.

Through this committee the authorities were induced to provide for the enlistment of medical students of recognized schools in the Enlisted Medical Reserve Corps, while allowed to continue their studies. This enactment, while not exempting medical students from military service, allows them to finish their course before being called. As a result, practically every drafted medical student and hospital interne who graduated in 1917 is now in the Enlisted Medical Reserve Corps. Effort is being made to secure a similar provision for premedical students, so that, while ultimately they will be called for military medical service, they may first be allowed to complete their course.

As soon as war was declared, the committee sought to have the Federal Trade Commission provide for the manufacture here of salvarsan and other German-owned medicinal preparations. After considerable negotiation, license to manufacture these preparations has been given to American concerns. The quantity of salvarsan which a year ago sold at $4 and higher is now easily obtained, American made, and furnished to the government at $1, and in large quantities at a proportionately reduced price.

The committee has made considerable effort to have the rank of medical officers made commensurate with the service which the Nation expects from the profession.

MEDICAL ADVISORY BOARDS

In November, 1917, the Provost Marshal General requested the Council of National Defense to nominate a representative man in each state to serve as medical aide to the governor to advise in the operation of the selective-service law. The chairman of the General Medical Board immediately appointed a Committee on Medical Advisory Boards, which met in Washington and selected a representative from each state. These representatives were called to Washington to attend a conference and to receive their instructions. The medical aides have been of great assistance to the governors, practically all of whom have expressed their gratification at the whole-hearted way in which the aides have cooperated with them.

A definite plan was formulated by this committee outlining the duties of these aides in the selection of the personnel of medical advisory and local boards and the supervision and organization of all medical activities under the selective-service act. Rules of procedure were prepared and approved by the Provost Marshal General.

MEDICAL SCHOOLS

Immediately upon its appointment in April, 1917, the Committee on Medical Schools took steps to survey the medical school situation, for the purpose of conserving the future supply of medical men by inducing the students to continue their medical education in order that their trained, rather than

untrained, services might be at the disposal of the government. Continuous courses canceling the summer vacations for the students were considered, but deemed unnecessary up to the present time.

The medical schools were urged to reduce their faculties to a minimum in order that as many teachers as possible might be released for enrollment in the Medical Reserve Corps. The schools furnished the committee with lists of those necessary for the successful operation of the institutions.

Through the efforts of this committee, third and fourth-year students subject to the draft were allowed to enlist in the Enlisted Medical Reserve Corps and placed on inactive duty, in order that they might complete their medical education, with the understanding that they would apply for commissions in the Reserve Corps upon graduation. Medical schools were asked to allow fourth-year students to substitute the senior year in base hospitals instead of school if emergency arises.

Letters were sent to presidents of universities and colleges asking them to advise premedical students to enroll in the medical schools of their choice as soon as possible.

NURSING

The Committee on Nursing has made a comprehensive survey of the nursing situation of the country for the benefit of the Army, Navy, Public Health Service, and American Red Cross. The committee includes in its personnel the heads of the nursing services of these departments in addition to the leading representatives of the profession in the country, with the result that the nursing resources of the nation are co-ordinated in such a way as to be of greatest value to the military medical departments.

In addition to instituting a publicity campaign aimed to interest young women in nursing as a career in order that they might upon completion of their training fill institutional positions, thereby releasing trained nurses for duty with the fighting forces, the committee has made a direct appeal to graduate nurses to enroll in the Army, Navy, and Red Cross nursing services.

With these objects in view, the committee has sent 12 circular letters aggregating 38,000 to presidents and deans and to 1917 graduates of women's and coeducational colleges and universities; to secretaries of boards of education; to principals of high, technical, and private schools for girls, and to 1917 graduates of the same; to superintendents of hospitals and superintendents of training schools for nurses; to state boards of nurse examiners; nurse registries, and 1917 nurse graduates. These letters were designed to appeal to educated young women to enter the field of nursing as a war service and as a profession; to interest hospitals and training schools in increasing their capacities for pupil nurses; to find which hospitals could increase their capacities; to stimulate the enrollment of graduate nurses for military duty; and to obtain reliable information concerning the present supply of nurses and of the potential resources now in the training schools of the nation.

Letters of inquiry also have been sent to selected groups, asking as to special preparation of nurses for opthalmological nursing, nurses who have special qualifications, the ratio of students who graduate to those who enter training schools, and the proportion of alumni who have families dependent on them.

Six leaflets, pamphlets, and monographs have been prepared and circulated to these and to thousands of individual inquirers. The total of these editions has been 87,000. They have been designed to create a widespread interest in the nursing profession and to instruct prospective applicants in the choice of training schools and how and where to receive information concerning them.

A three months' carefully prepared publicity campaign was conducted under a well-known magazine writer and editor; and a series of 12 articles on nursing was printed in 192 newspapers, published in 39 states and Hawaii.

Early last summer the Committees on Nursing authorized a survey of nursing resources in the United States. While the returns are avowedly incomplete, they show a definite minimum. No survey was attempted in Arizona, Nevada or New Mexico, these states having no state nurses' associations. The last returns were received in March. Among the most important statistics supplied are the following:

Graduate nurses:		
Registered	66,017	
Not registered	17,758	
Total graduates		83,775
Graduates in 1918:		
From the 1,579 accredited schools	13,288	
From 414 non-accredited schools	1,099	
Total graduating in 1918		14,387
Graduate nurses available at the end of 1918		98,162
Student nurses:		
In accredited schools		38,938
In non-accredited schools		3,633
Total student nurses in all schools		42,571

NOTE.— In statistics of students, as given with the list of registered schools by the publication committee of the American Nurses' Association just issued, the number of students in excess of the above is 7,553. This would bring the number of students in all schools up to 50,124

The committee has recently followed up the questionnaire sent to training schools and registries late last summer by a second letter and question-

naire to superintendents of 1,500 accredited schools and to 65 professional nurse registries. The first rough analysis of returns from this questionnaire gives the following information:—This amply supports the findings of the former ones and shows that schools of nursing are making a remarkably fine response to this appeal for patriotic service. In 709 schools (representing only half of the schools) there were accepted during the year 1917, 3,803 extra students, and during the spring of 1918 there will be received 3,219 extra students. This makes a total number of 7,022 additional students admitted up to the end of the spring term. One hundred and thirteen schools state that their obstacles in the way of increasing the number of pupils are due to lack of housing facilities.

The committee is now completing rather extensive plans for a campaign designed to fill the spring classes of every accredited training school of the United States to capacity by June 1st. The cooperation of the section on state councils, the woman's committee and the national association of collegiate alumni is assured. A handbook for speakers is now in press for this purpose.

The committee recommended that accredited training schools giving a three years' course crowd forward the theoretical instruction and hold final examinations and graduation exercises as early as possible in 1918, and release their graduates, providing the government needed them, and they would enter directly into government service.

The committee has authorized and indirectly prepared the details of an intensive preparatory course in nursing for college graduates to be given at Vassar College during the summer of 1918, this course being open only to women who shall have previously registered with an accredited training school for nurses for entrance in 1918 for an additional two years of regular nurses' training.

The following recommendations, with the approval of the Army and Navy Nurse Corps, have been addressed to the Surgeon General of the Army through the Executive Committee of the General Medical Board, and have been favorably received by the Surgeon General of the Army and the Secretary of War:

That houses be rented, and transportation to the nearest town be provided when necessary to accommodate the nurses in lieu of available tents, barracks, or other temporary shelter;

That a regular quota of not less than one nurse to six acutely ill men be provided; and

That a reserve of not less than 25 over the prescribed quota be stationed at each hospital to meet emergencies and secure special training in the military establishment.

The committee further recommended that a tour of inspection be made by a qualified nurse to make observations regarding the nursing service in the military and naval hospitals in the United States; and that this privilege be accorded to Miss Annie Goodrich, member of this committee and of the Red Cross committee on nursing service, and president of the American Nurses Association. The Surgeon General has appointed Miss Goodrich inspector general of the nursing service in the United States and France.

The committee has regularly conferred with the Red Cross department of nursing through its director, and in December recommended that certain reorganizations of the bureau of nursing be made in order to hasten the enrollment and assignment of nurses; that the Red Cross be permitted by the War Department to make temporary assignments of nurses in times of extraordinary need as it does to a civil community in disaster, and that the Red Cross undertake an extensive publicity campaign for the enrollment of nurses for military and naval service. All these recommendations have been accepted and acted upon.

The committee has been instrumental in securing the inclusion of nurses in the war-risk insurance law, and has assisted in gathering data for the War Department's reconstruction program.

The committee has produced evidence to show the need for military rank for nurses, and has secured the indorsement of the executive committee of the General Medical Board, which has voted to recommend rank for nurses to the Advisory Commission and the Council of National Defense. Some of the members of the committee have recently assisted in the formation of a new committee under the Red Cross, composed of nurses and lay women who are endeavoring to secure rank and an increase in the pay and allowances of nurses.

State committees on nursing have been formed under the woman's committees of the state councils of defense in twenty-seven states. Through cooperation with the Committee on States Activities, the section on state councils, and the woman's committee, this committee has exerted a potent influence in checking and in several states overcoming a popular demand for short-term courses in nursing, while expressing its indorsement of the Red Cross nurses aid course if and when the supply of nurses should become inadequate; in securing financial aid for hospitals which were willing to increase their classes of nurse students, and in conducting carefully worked out programs for increasing the numbers of candidates for nursing education.

SUBCOMMITTEE ON PUBLIC HEALTH NURSING

This committee was first of the three committees on nursing, now recognized by the Council of National Defense (the others being the general nursing committee and the committee on home nursing of the committee on labor), to establish connections with the Council. At its first meeting it recommended the appointment of the committee on nursing, and that a survey of nursing resources be undertaken by the new committee. An informal report was prepared concerning the war's effects on health protection activities in Europe, and a letter and ques-

tionnaire were sent to 130 representative public health nursing agencies, seeking similar information and suggestions for action.

The committee secured from the Red Cross bureau of nursing a statement that a special enrollment of all public health nurses exclusively for public health nursing would be granted. Following this assurance, this committee sent a letter and questionnaire to 2,500 public health nursing agencies in the United States, asking them to indicate the members of their staffs who could be spared. The secretary of this committee has also acted as chairman of an advisory committee to the Red Cross nursing service in the selection of superintendents of public health nursing units.

An experiment in co-operation with the United States Food Administration has been undertaken in two states whereby public health nurses will be given special practical instruction in food economics based on war substitutes, which they in turn will transmit to mothers in the homes which they visit. This is to be extended into all the states where public health nurses are engaged.

This committee recommended to the Red Cross nursing service that a superintendent of public health nursing in the extra-cantonment zones be urged, and recommended that Miss Mary E. Lent, associate secretary of the National Organization for Public Health Nursing, be nominated to the Surgeon General of the United States Public Health Service as a qualified candidate for the position. General Blue approved the nomination and appointed Miss Lent a member of his staff.

In co-operation with the National Organization for Public Health Nursing, this committee submitted a plan to increase the supply of public health nurses to meet war needs in general, and the "children's year" program in particular. This committee has indorsed recommendations regarding the importance of extending provisions for industrial nurses in connection with the program in behalf of the health, housing, and general protection of industrial workers.

Four lectures on venereal disease have been prepared for distribution to the superintendents of accredited training schools, with the request that they be presented to their 1918 classes in order that no graduate may be ignorant of this important subject. The same material is being sent to all public health nurses. The superintendents of training schools are also asked to give these lectures in amplified form to succeeding classes unless the subject of venereal disease already receives similar consideration in their curricula.

RESEARCH

The Committee on Research has conducted its activities in co-operation with the National Research Council. This committee has been of invaluable assistance to the medical departments of the Army and Navy in investigating, through the laboratories available for its purposes, the vast number of medicinal preparations and appliances submitted to the Army and Navy for adoption by private individuals and firms. Every product or appliance receives careful investigation, and a report is made to the department interested with recommendations as to its adoption, if applicable to military needs, or final rejection.

Toxicity of canned food. Early in the organization of the National Research Council, it was asked by a national association particularly interested to undertake, or to supervise, an exhaustive study of the conditions under which canned foods might become, and sometimes do become, deleterious. The National Research Council referred this matter to the Committee on Medicine and Hygiene. Prof. M. J. Rosenau, of Harvard Medical School, was induced to undertake the work, which has been carried on for more than a year.

Digitalis grown in America. Up to the entry of the United States into the war this country had depended largely upon German houses for crude drugs and the chemical extracts made from them. For example, the United States was using German-grown digitalis. Certain universities, notably those of Minnesota, Wisconsin, and Oregon, had for many years in their pharmaceutical departments grown small areas of digitalis and other medicinal plants. More fortunately still, Professor Rountree, of the University of Minnesota, had made pharmaceutical tests of the digitalis grown in connection with this university and had found it quite equal, if not superior, to German-grown plants. The research committee appealed to this university and it responded promptly and patriotically. During the summer of 1917 it grew and harvested about two acres of digitalis, at a cost of approximately $3,000. In addition to this, wild digitalis in Oregon and Washington was gathered in considerable quantities, and all this material has been properly prepared and turned over to the Medical Supply Department of the Army, so the supply of digitalis in this country is ample. The American-grown digitalis is a different species from that ordinarily grown in Germany, and this species has proved pharmaceutically to be even better than the German species.

Dr. Bull's work on antitoxin for the Welch bacillus. This work marks, scientifically, one of the most practical advancements of the year. Dr. Bull, in the Rockefeller Institute, assisted by Miss Pritchett, has worked out and made practical an antitoxin which has been demonstrated successfully in England and France both for its prophylactic and its curative properties in animals and in man. It is hoped that this antitoxin will rob the gas bacillus of its horrors and will greatly aid in the surgical treatment of infected wounds.

Ear protectors. Early in the summer of 1917 the Research Committee took up the question of protectors for the ear-drum against the noises of battle. Two investigators, Prof. Michelson, of the Univer-

sity of Chicago, and Dr. J. Gordon Wilson, of Chicago, evolved and prepared a hard-rubber ear protector, and it may be of interest to note that one of these has already done valuable work on injuries to the ear from explosives in hospitals in France and in England.

Later, Prof. Stacey Guild, of the University of Michigan, undertook to test out all known devices for the protection of the ear from injuries due to high explosives, and he has published, at the request of the National Research Council, three valuable papers upon his work, which has been tested out and confirmed by representatives of the Surgeon General's office at Indianhead and elsewhere. It may be interesting to state that of all the ear protectors devised up to the present time and tested by Prof. Guild, the "English Tommy" has proved to be the most efficient. This is cheap and can be supplied in quantity. Every soldier can carry any reasonable number and no special skill is required in the application of the protector.

Study of antiseptics and disinfectants. The Research Committee is indebted to many chemists, bacteriologists, physiologists, and pharmaceutists throughout the country for much laborious and time-taking study of almost innumerable so-called antiseptics and disinfectants presented to the committee. It would require too much space to go into detail concerning these studies. Most of these investigations are indexed and carded and are to be found in the offices of the General Medical Board of the Council of National Defense. The Research Committee proceeded on the ground that in order to silence all criticism every preparation, whatever its source, should be submitted to examination and its claims tested out in the laboratory and in the hospital. These investigations have been chemical, bacteriological, physiological and clinical, and even when the preparation submitted was evidently valueless, it was referred to some investigator and tested out in all thoroughness. The information thus obtained has been supplied in every case to the Medical Supply Department of the Army. Some valuable cocaine substitutes have been found and are now in use. Some effective, cheap disinfectants have been supplied. Proposed substitutes for salvarsan and other drugs have been tested and proved valueless.

The most valuable contribution along this line lies in the fact that a very large number of absolutely worthless preparations have been appraised at their true value and their vendors, in their attempts to sell to the government, have been effectually silenced. No one has been able to claim that injustice or partiality has been shown.

Production of acetone by the fermentation of starch. In England for some time acetone was largely used in the manufacture of explosives, and it was produced by the fermentation of cornstarch. Although an ally, England was bound by a contract with the discoverer of this process so that the United States could not obtain the secret. Prof. Levin, of Rockefeller Institute, is now at work on this matter and at last report had obtained quite satisfactory results.

Dried tetanus as antitoxin. Rumors came to this country that the Germans were using a preparation of this kind in the treatment of wounds. The Research Committee found that Prof. Robertson, of the University of Minnesota, had done some work along this line in Germany. Inquiry brought forth a statement that the result of the experiments would justify them in producing a first-aid method of administering tetanus antitoxin by drying it on pieces of gauze or cotton and carrying it in this dried condition in the first-aid package. It was found that if these dried pads were placed on wounds, they would give protection to animals which have received from two to five times the minimum lethal dose of tetanus toxin. The investigator says that while the experiments have not been finished, they point to the possibility of considerable reduction in dosage with full and adequate amount of defense provided, and that the short time the antitoxin immunity persists renders in a great many cases a second dose necessary in any event, and that the smaller doses seem to be fully as efficient as the larger ones.

Study of hæmostatic preparations. Prof. Lief, of Columbia University, who, at our request, undertook this investigation, has found that various preparations of thromboplastin are more or less efficient in shortening the period of time for the coagulation of blood.

Study of shock. In June, 1917, the Research Council made rather extensive preparation for the study of shock and this was placed in the hands of a member of the committee, Dr. Crile. However, this matter has grown and ramified in so many directions that it is now no longer under the charge of the Research Council.

Substitutes for ambrine. About the time America entered the war there was much discussion among clinicians concerning the use of a proprietary preparation used in France in the treatment of burns and known as ambrine. At this time it was practically impossible to obtain ambrine in this country, and what little could be obtained sold for a fabulous price. At the request of the committee several men in this country began to search for substitutes for ambrine, having first tested and apparently demonstrated the value of this preparation in the treatment of superficial burns. Chemists began attempts to prepare substitutes and this has been worked out satisfactorily.

Possibility of disinfecting wounds by means of gases. Various machines and preparations have been submitted for the purpose of sterilizing wounds and meningococcus and other carriers. All of these, with possibly one exception, have proved without value. The one possible exception is an apparatus for the disinfection of wounds and for the sterilization of carriers by means of a terpezone preparation.

Sterilization of drinking water. A year ago many claims for processes to be employed by the Army in the sterilization of drinking water were made to the committee. Among these may be mentioned sterilization by ultraviolet rays, by ozone, by various chemicals, and by various forms of apparatus for heating and distillation. The Research Committee asked Professor Phelps, of the hygienic laboratory, and Professor Whipple, of Harvard University, to prepare a definite statement along this line. These gentlemen recommended chlorine, and it is now used everywhere and under all conditions.

Injuries of the peripheral nerves. Professor Huber, of the University of Michigan, was asked by the Research Committee to prepare a review of the war literature bearing on this subject. This was done in a most complete and satisfactory way, and the report has been published.

Methods of destroying lice. In the first place, the committee abstracted and published the literature upon this subject which was obtainable a year ago in France and England. Professor Moore, of the University of Minnesota, at the request of the committee, has taken up this matter experimentally and has made a preliminary report.

Value of agglutination tests after vaccination for typhoid fever. At the request of the Research Committee Major Rist, of the French Army, has prepared and published a statement of the results obtained by himself and other French investigators as to the value of the Widal test after vaccination for typhoid fever.

STATES ACTIVITIES

The Committee on States Activities, upon its appointment in April, 1917, concentrated its efforts primarily on supplementing the activities previously initiated by the Committee on Medicine and Sanitation to increase the enrollment of medical men throughout the country in the Medical Reserve Corps.

With the assistance of the state and county committees, this committee classified the medical profession according to availability for service in the Medical Reserve Corps, and those not available because of home needs. Twenty thousand physicians recommended by the state and county committees for enrollment were written to from Washington and urged to enroll, complete data as to their professional experience being tabulated, card indexed, and classified. Certain members of the various state committees were appointed as examiners to tour their states to examine candidates for the Medical Reserve Corps. Monthly tabulations showing comparative percentages of enrollments in the corps in each state are regularly issued and distributed to the state committees, with the idea of encouraging competition between the states.

Members of the committee have toured the country for the purpose of arousing interest in the Reserve Corps. More than forty states have been visited and meetings held in all the largest cities. Special letters have been sent to county committees urging members personally to interview physicians who could be spared, to medical graduates of 1914–1917 urging enrollment, to local medical societies suggesting methods to protect the practice of physicians called to the service, to candidates rejected for slight physical reasons, urging adoption of means to correct such defects, letters of advice to physicians desiring foreign service, to physicians who could be spared from hospital staffs, urging enrollment, and urging physicians who were offered commissions in the Medical Reserve Corps to accept them promptly.

Replies have been made to numerous inquiries from state and county committees, medical, dental, and veterinary schools and students, and hospital internes, with reference to exemption from military service until completion of medical education.

Statistics have been formulated and information secured on which was based the plan for the enlistment of medical students and internes in the Enlisted Medical Reserve Corps, placing them on inactive duty until graduation, the committee cooperating with the Committee on Legislation in executing this plan.

Representatives of the state committees attended a conference in Chicago in October, 1917, on the call of the chairman, at which time the many details as to enrollment were explained, and the conference did much to stimulate applications for commissions. It was at this meeting that the plan to organize the Volunteer Medical Service Corps was introduced.

The committee has co-operated with the Committee for Civilian Co-operation in Combating Venereal Diseases and urged the support of the state committees in those states where legislation and medical assistance was necessary.

This committee is assisting the Committee on Medical Advisory Boards and the central governing board of the Volunteer Medical Service Corps as well as the other committees of the General Medical Board in bringing to the attention of the profession at large activities in which it is desirable to enlist the aid of the general medical public.

SURGERY

Upon the recommendation of the Committee on Surgery, the records of the members of the Medical Reserve Corps were classified according to professional and military qualifications and this information supplemented by confidential information as to ability for certain appointments in the military service. This information has been transferred to code cards, one set remaining in the offices of the Council of National Defense, and two sets being forwarded to the Surgeon General's office, one for retention there and the other to be sent to General Pershing's headquarters in France.

The following subcommittees on surgical specialties were appointed:

Subcommittee on ophthalmology. This committee immediately upon its appointment in May, 1917, proceeded to survey the ophthalmologists of the country for the purpose of requesting those available to enroll in the military service. All ophthalmologists not required for institutional and civil needs were requested to join the Medical Reserve Corps, a total of 6,075 letters being sent out. Methods of eye examinations were standardized. A conference on the re-education of the blind soldiers was held and a survey made of workshops for the blind. The committee ascertained the number of artificial eyes in stock in the country, and investigated the manufacture of glass used in binoculars, field glasses and range finders, and optical glasses used for aviators' and ambulance drivers' goggles. Other data of considerable importance were collected by this committee, to be used in connection with reconstruction work.

Subcommittee on otology, rhinology, and laryngology. The subcommittee on otology, rhinology, and laryngology was appointed June 25. The otolaryngologists of the country were surveyed and classified and those available for military duty requested to join the Medical Reserve Corps. Letters to the number of 2,925 were sent out. This survey included brain, oral, and plastic surgeons.

The committee aided in revising the requirements as to hearing for entrance to the Army, and in the assembling of tests for malingerers.

To ascertain the best ear protectors for use in the service, tests were made and a report submitted to the Surgeon General, who has acted upon it. Special otolaryngological lectures were delivered at the cantonments, and the manuscript for a war manual of otolaryngology has been prepared. A card diagnostic sheet for use in cantonment base hospitals has been devised. A report regarding the reconstruction of the defects in hearing and speech was made to the Surgeon General's office.

The committee has aided in the standardizing of otolaryngological instruments, and participated in the reconsideration of the instrument list, with a view to revision, enlargement, and completion, for the base hospitals in camps and cantonments.

On July 9, 1917, the two subcommittees mentioned above met together as a Committee on Head Surgery. This joint committee recommended special hospitals for the treatment of eye, ear, nose and throat cases, and prepared plans for a special hospital and dispensary building in cantonments. This committee also recommended that specialists trained along certain lines be assigned to special duty in military hospitals. It further recommended that for each group of several general hospitals there should be a head hospital, with one brain surgeon and four assistants; one chief ophthalmic surgeon with two assistants; one chief nose and throat surgeon and four assistants; and that four ophthalmic and six ear, nose, and throat surgeons be assigned to each division of the mobile forces.

VOLUNTEER MEDICAL SERVICE CORPS

In order that the services of physicians ineligible for appointment to the Medical Reserve Corps on account of over-age (55), physical disability, or civil or institutional needs, and women physicians might be utilized by the Government, the Council of National Defense, upon the recommendation of the chairman of the Committee on Medicine and Sanitation, authorized and directed the committee to organize the Volunteer Medical Service Corps. A special committee to draft a plan was appointed, and on January 13, 1918, the plan presented to the General Medical Board was approved. The central governing board, in which is vested the general management of the corps, was appointed and the machinery has been set in motion to secure members, first application blanks being sent to the 5,000 doctors ineligible, because of slight physical disability, for the Medical Reserve Corps. The central governing board is a committee of the General Medical Board. The state governing boards consist of the state committees, medical section, Council of National Defense.

The services of members of the corps will be rendered to existing governmental agencies upon the request of the Army, Navy, Public Health Service, and American Red Cross to fill certain needs not already covered, and such other services as may be determined by the central governing board of the Volunteer Medical Service Corps.

WOMEN PHYSICIANS

The Committee of Women Physicians made a comprehensive survey of the women doctors of the country, of whom the loose-leaf census in the possession of this committee shows there are 5,989, and of these 5,788 are in active practice. The committee has registered 1,916, which is 33.1 per cent. Indorsed lists of anæsthetists, laboratory workers, radiographers, and sanitarians have been prepared with the assistance of experts in each line.

Of those who offered their services to the government, 803 are listed under the following specialties: administration, 58; anæsthetics, 180; bacteriology, 24; chiropody, 1; dermatology, 1; dietetics, 5; electrotherapy, 11; eye, ear, nose, and throat, 34; gastro-enterology, 1; general laboratory work, 74; genito-urinary, 1; gynecology, 149; hydrotherapy, 2; hygiene, 13; interpreters, 18; kinesiatrics (medical gymnastics), 3; lectures, 9; neurology, 36; obstetrics, 146; orthopedics, 13; pathology, 18; pediatrics, 121; physical examinations, 2; psychiatry, 59; public health, 12; radiography, 21; reconstruction, 1; research, 6; sanitation, 36; surgery, 196; tuberculosis, 14; venereal, 3. There are 188 willing to accept contract positions, and the 1,113 others stated that their services are available for substitute work in hospitals or private practice, service under the Red Cross, in industrial plants, and for part-time service in their home communities.

MEETING OF STATE COMMITTEES OF MEDICAL SECTION, COUNCIL OF NATIONAL DEFENSE, WITH STATE ACTIVITIES COMMITTEE AND GENERAL MEDICAL BOARD

THREE hundred physicians and surgeons, members of the State and County Committees of the Medical Section of the Council of National Defense, representing every State in the Union except one, met at the New Willard in Washington on Saturday and Sunday, May 4 and 5, called together by Dr. Franklin Martin, chairman of the General Medical Board of the Council of National Defense.

Attention was focused on two important subjects: Increased enrollment in the Medical Reserve Corps of the Army and Navy; definite plans for the enrollment in the Volunteer Medical Service Corps of those physicians not available for active military service to meet the medical needs of the whole Nation.

Pleas for the immediate enrollment of 5,000 additional members of the Medical Reserve Corps of the Army and 1,000 for the Naval Reserve Force were made by Surgeons General Gorgas and Braisted. Members of the State and County Committees were urged to increase their activities as the authorized governmental agencies for the mobilization of the Nation's medical resources.

MORNING SESSION

The meeting on Saturday morning was called to order by Dr. Franklin Martin, chairman of the General Medical Board, who called to the chair Major Edward Martin, of Philadelphia, chairman of the State Activities Committee.

The Council oath of office was administered to members of the State committees, confirming them in their official capacity as the authorized representatives of the Council of National Defense.

In his address of welcome Major F. F. Simpson, vice chairman of the board, called attention to the fact that one year previous to the entry of this Nation into the war, a national committee on medical preparedness was organized and under its direction the State and County Committees were called into service, these State and County Committees being taken over as a part of the Medical Section of the Council of National Defense upon the organization of that body.

Surgeon General Gorgas spoke of the organization of the Medical Reserve Corps and its expansion during the war, until it now includes 20,000 members through the activities of the Medical Section of the Council of National Defense; expressed his appreciation for the great work already accomplished and in anticipation of its continued activities along the same lines, which would insure an ever-increasing supply of men for the Reserve Corps. He called attention to the immediate need for 5,000 additional men in the Reserve Corps and stated that he had just received a pressing call from General Pershing, asking that 500 medical men be forwarded immediately to France. "If the men will come in now," said General Gorgas, "500 will stand the chance of going to France at once, and as there will be numerous requests, nearly everyone can go to France. A few good men must always remain on this side. I am glad to express my gratitude for the assistance you are going to give us in the next two or three months."

Admiral Braisted urged the needs of the Medical Reserve Corps of the Navy. "Needs not quite so large as the Army's, but just as necessary. What we need is a gradual, constant influx of splendid medical personnel to meet the needs of our service. The work seems greater than it did a year ago. More and more the work is expanding and growing into new fields. We shall need in this new year every bit of help we can get. This great Council of National Defense stands as the leading organization to help us in our work in the war."

Mr. W. S. Gifford, Director of the Council, referred to the legal authorization of the work of the Council, that "it was to create a relation that would bring about in time of need the immediate concentration and utilization of the resources of the Nation. We have considered that it included the medical resources of the Nation as well as industrial and other resources. In Washington we would have a directing and guiding agency, but that the work must be done by the people of the country."

Colonel Caldwell, of the Surgeon General's Office, presented figures as to the number of medical men in active service in the various corps: Medical Corps, 843; Medical Reserve Corps, 16,552; Medical Corps, National Guard, 1,027; Medical Corps, National Army, 114. He congratulated the profession upon the fact that this "aggregate of medical officers had been contributed to the Medical Department of the Army by purely voluntary effort. It is the desire of the Surgeon General of the Army, in so far as the medical profession will consent to, and will volunteer to do, to mobilize the medical personnel of the country for the purpose of our military uses. This will best be accomplished by all medical men who are able-bodied, who are professionally competent, and who can leave their civil activities without sacrificing the activities of the community, industry, or corporation to come into the Reserve Corps voluntarily and accept commissions. If this were done, it would be a simple matter for the Surgeon General to properly officer the military medical forces with competent medical personnel. It would make the task of the Council of National Defense and the different Surgeons General very easy in taking care of the

civil communities wherever they may be in need of competent professional assistance.

"The Personnel Division of the Surgeon General's Office has arranged to have at convenient places — has about completed the arrangement in every State of the Union, including the Capital — examining boards for applicants for commissions in the Medical Reserve Corps. With this understanding and your efforts when you return home to your activities in the different States, the Surgeon General feels confident there will be no question as to the securing of 5,000 additional medical officers for the Reserve Corps in the next few months."

Medical Inspector Murphy explained the need for a large increase in the Navy Medical Corps. "At one time last year we found we had sufficient medical officers for our needs. At the present time, despite the forecast, we find that we need more, and it is hoped that you gentlemen of the State Committees of the Medical Section of the Council of National Defense will help us obtain this additional medical personnel. We need a thousand, we calculate, for the coming year. It is hoped that we will obtain, with your assistance, at least 100 a month so as to be safe. I would like to extend to you again on my part, as the Surgeon General has already done for himself, our appreciation in the Medical Corps of your efforts in our behalf, and trust that the future will bring to us your kind assistance once more. At the present time there is a bill before Congress increasing the Navy, almost doubling it. We will require more men. All new ships built here and everywhere, that no one knows about, will need new men. From France we get the request in connection with the American Expeditionary Force from Gen. Pershing that more naval medical officers are needed."

Major John D. McLean spoke on the work of the States Activities Committee, referring to the organization of the State Committees a year previous to the entry of this Nation into the war and their inclusion in the Medical Section of the Council of National Defense upon its organization. He reported in detail the service rendered by the Committee to the Surgeons General of the Army, Navy, and Public Health, in securing detailed information as to men available for membership in the Medical Reserve Corps and the enrollment of 20,000 medical officers during the past year. Through this Committee, in co-operation with the State Committees, has been disseminated a vast amount of information relating to every aspect of the nation's medical activities; in co-operation with the Provost Marshal General's Office it has prepared rules of procedure for the organization of Medical Advisory Boards, it has aided in the selection of medical aides for the governors of the several states, and formulated plans outlining the specific duties of such medical aides.

This Committee formulated the plans and inaugurated the Volunteer Medical Service Corps as authorized by the Council of National Defense. For membership in the Corps such physicians are eligible as would be accepted in the Medical Reserve Corps of the Army were it not for physical disability over age, essential public need, essential institutional need, or dependents. Women physicians are eligible. The object of the Corps is to establish an emergency medical organization to perform, when required, such civic and military duties as are not provided for. State governing boards consist of the members of the State Committees of the Medical Section of the Council of National Defense, and from this board in each State are selected five men who act as an executive committee to pass upon applications for membership. Upon their recommendation, applications are passed to the Central Governing Board in Washington. Each member of the Corps, during active membership, is entitled to wear the insignia of the Corps, as authorized by the Council of National Defense.

The officers of the Corps are as follows: President, Dr. Edward P. Davis; Vice-President, Dr. Henry H. Sherk; Acting Secretary, Dr. John D. McLean. The Central Governing Board includes the above-named officers, Dr. Edward H. Bradford, Dr. Truman W. Brophy, Dr. Duncan Eve, Sr., Dr. William Duffield Robinson, Dr. George David Stewart, and ex-officio, Dr. Franklin Martin and Dr. F. F. Simpson.

Dr. Edward P. Davis, of Philadelphia, spoke of the purpose of the Volunteer Medical Service Corps. "Would it not be a source of inspiration, gratification, and pleasure if we were organized in the service of our Government, and if we had something to show for that organization? Those of you who are on Medical Advisory Boards for the selective-service enlistment have been doing splendid work which is typical of this class of men. Others of you are teachers in medical colleges. Others are holding position in great city hospitals, where their absence would leave the hospital sadly crippled. There are many activities along the lines of executive, educational, and institutional work, and other things in which we can serve. You may be asked to go to a neighboring camp as consultant. During that work you will be co-operating actively with the Government, and you will have an insignia worn in your buttonhole, and this will identify you as an officer of the United States Government upon temporary active duty."

Dr. Harry M. Sherman, of San Francisco; Dr. H. H. Martin, of Savannah; Dr. Charles E. Kahlke, of Chicago; Dr. J. A. Witherspoon, of Nashville; Dr. Rock Sleyster, of Waupun, Wis.; and Dr. George D. Stewart, of New York, told of the progress of the work of the State Committees in their several States.

Dr. Franklin Martin spoke feelingly of the situation in England and France and their great need of doctors, and of the work of the American surgeons in the war zone.

"In those hospital clearing stations back of the lines, our men — men who were in this fight early and were over there first — the best men we have —

are working two shifts from 12 to 12. Do they stop at the end of the shift? No; they work from 12 to 12 and then go on. They sleep three or four hours and then go on again. For a half mile outside of these hospitals men are waiting to be operated upon. They send out the orderlies and tell them to bring in the worst. That is the job 'over there.'

"Do you realize that the Government did better than it knew and that Congress probably did better than it knew when it passed the law establishing the Council of National Defense? When war came on, fortunately, we had a little part in that Council of National Defense. What was our first thing to do? To help the bureaus and departments to expand as rapidly as possible in preparing for the coming war, and when war came, to still further expand those departments.

"You had been working one year before war began, under Dr. Simpson and Dr. Mayo. You had worked so well that as soon as the Council of National Defense was organized—at its first meeting—I asked them to take over this organization as the Medical Section of the Council, and from that time it became a part of the Council of National Defense. The resolution was passed, and at that minute you became just as much Government officers as though you had been receiving a salary and had a definite appointment. Do not think that thePresident does not know everything of importance that happens at each meeting of the General Medical Board, and everything of importance that is announced from the activities of these committees. He is deeply interested, as I know from conversation with him. He knows the subject from the beginning in April, 1916—a year before the war began—until the day before yesterday, and he regrets exceedingly that he is not here this morning to say how much he appreciates what you have done for him. He wants you to know that you are the authorized organization to carry on this work in connection with the departments of the Government. I quote from a personal letter:

> " 'Thank you for telling me of the approaching meeting of the State Committees of the Medical Section, Council of National Defense. Will you not be kind enough to convey to them, when they convene, a message of sincere appreciation from me of their services as authorized governmental agencies to the Army, Navy, Public Health Service, and American Red Cross, and of the part they have played in the preparation for war? Will you not at the same time convey to them my warm personal greetings?'

"In organizing these committees and the original committee that became the General Medical Board we have insisted upon only one thing, that any organization anywhere could suggest members to the General Medical Board, and if those members were approved by the General Medical Board they would be accepted as individuals and not as members of an outside organization, because as soon as they became members of the General Medical Board, and as soon as you became members of the State Committees of the Medical Section, you became Government officials.

"The one thing we have gotten you here for more than anything else is to change your attitude from that of complacency to that of the man who is at the front and has gotten up his wind for the fight. When you go back home, get the members of your committee together and do the work we want you to do as promptly as possible, and convey the results to us as promptly."

AFTERNOON SESSION

DR. EDWARD MARTIN, Chairman: "The purpose of this meeting is to justify our existence. At the meeting in Chicago last fall, attended so largely by you, there was probably more constructive work done than at any medical meeting in this country, and the plans there suggested have been going on steadily every day since. First, we wish to formulate a plan by which we may deliver to the Surgeon General of the Army 5,000 medical men before the 1st of July, and probably many more within the next year. To do that requires much wisdom, much time, and an absolutely concentrated effort on the part of everyone of us. The first 5,000 will be easy. The next 10,000 will be most difficult. But you men can do it. It is our feeling that the only way we can get men is man to man, from you to them. Your Central Committee met yesterday and laid out a tentative scheme upon which we want your constructive criticism and help. We feel that if we can get together on this matter we can give the Surgeon General the men he wants, and the tentative scheme is this: That each State Committee, with the help of the County Committees where this seems desirable, take their tabulated lists of the profession in their State and select from that list twice as many men as will be wanted in this first call, and notify each one of those men, preferably by personal interview by the Chairman, or by interview on the part of one of the County Committeemen, or if not that by letter, telling, in the first place, of the broad general need; and, in the second place, of the immediate, pressing, and urgent need; and, in the third place, that he has been selected by the State Committee as the man to at once apply for a commission and subject himself to the orders of the Surgeon General. That seems a simple, comprehensive way, and seems perhaps applicable to this whole country. The problem is different in each State, and each State must settle it for themselves.

"Suppose the man refuses. What is your next step? We will then ask you to send his name to the Committee's office in Washington. He will then receive a direct appeal to enlist because you have said he should. Suppose he refuses. We have nothing more to say, but we believe that any man who after that refuses to go into the service will find hell a more comfortable place. So you have them. At the first no violence but the kindest

treatment, but if needful I have the greatest confidence in the medical profession. We want no such man among us. It is needful that these men should receive certain definite information in regard to the requirements, the cost of equipment, salary, chance of advancement, and that has been formulated and will be sent to each one of you. We believe that every man between 21 and 31 should be in the service of the United States. If one of our profession has been taken in the selective service and put on the deferred list because of dependents, that is no impediment where enlistment in the Medical Reserve Corps is concerned. Nor has any man under 31 the right to be so prosperous that he can do much better by himself than the United States can do by him financially. We are after them. Our honor is involved. Our duty is to get them, and you will do it."

Thereafter followed a lively discussion of the numerous problems arising out of the work of the State and County Committees. The difficulties that have arisen in certain states with regard to the examination of applicants for the Medical Reserve Corps will be solved by a new plan of the Surgeon General for increasing the number of medical examiners and stationing them at a larger number of convenient points in each state, as explained by Colonel Caldwell. The complete details of this plan, including the location and personnel of the examining boards, will be forwarded to the State Committees.

Methods pursued in various states to secure complete data as to available men for active service were explained and discussed, as well as methods adopted to secure enrollment. Publicity in the newspapers was suggested as a most effective means. The quota of men desired from each county having been determined by the State Committee, the figures should be published in comparison with the medical population. These facts having been brought to the attention of each community, public opinion will supply the needed influence.

In answer to many questions concerning service in the Medical Reserve Corps, such as rank, pay, special work, etc., the State Activities Committee has had printed a "List of Questions and Answers" which is to be distributed through the State and County Committees. Copies of the pamphlet on War Risk Insurance, as issued by the Treasury Department, may be had on application to the Committee's office in Washington.

In reply to many questions as to the status of a physician under 31 years of age who had not received a commission in the Medical Reserve Corps because of physical disability and afterwards drawn into military service by the local advisory boards, it was pointed out that where such a physician had been sent into a camp and accepted by the surgeon in charge and enlisted as a soldier, he should notify his superior medical officer that he has applied for a commission in the Medical Reserve Corps. He will then be re-examined and the Surgeon General will give him a commission even if rejected by the medical examiner, except that he might be rejected on moral grounds. Col. Caldwell, of the Surgeon General's office, stated that "in every instance where a man has been actually enlisted in the army as a private the Surgeon General will commission him in the Medical Reserve Corps."

Senator Owen of Oklahoma was introduced. "It gives me a peculiar pleasure to have the opportunity of paying my respects to you and to your great profession. Nearly all of my people are surgeons and I have always taken a very lively interest in the profession.

"In the matter of preserving the lives of the young men we have drawn from the American homes and have sent to defend liberty and righteousness and humanity on the battlefields of Europe, I think it would be impossible for us to take too good care of them. For that reason I have particularly interested myself in having the organization of the Medical Department of the Army and the Medical Reserve Corps given the dignity and rank and position which will enable them to render the service which is required at their hands. In appearing before the subcommittee a day or two ago presenting the argument, I called attention to the fact that the organization of the Medical Department of the Army had by statute one brigadier general, who, during the life of Gen. Gorgas, should be a major general, but when he passes from this terrestrial sphere of usefulness, it will be as a brigadier general if the law stands. Under that organization in this war, under our present quota of troops, under Gen. Gorgas will be 20,000 officers, 50,000 nurses, over 200,000 enlisted men, probably 500,000 beds, allowing one bed to every four soldiers as the peak load, as we must be prepared for the maximum and not the minimum. We can not average the casualties of battle, but this great force, under the present organization of the Medical Department of the Army, omitting what the General Staff might be good enough to recommend to the President of the United States in regard to the Reserve Corps, is one general officer. I presented to the committee the organizations of the medical departments of the French Army, the British Army, the Japanese Army, and of all of the armies of the civilized nations of the world, but those three nations I refer to now have in general officers in the medical organization of those armies an average of more than twice as many as I have sought to obtain in the organization of our own Army. Some men are thoughtless enough to think that in asking for these general officers it is a contest of individuals for rank. It is not a contest of individuals for rank. I do not regard the rank of major general as conferring any additional dignity upon Crile or Mayo. The value of these dignities is to enable the men charged with gigantic responsibilities and preserva-

tion of men the ability to better discharge their functions.

"I called the attention of the committee to the fact that one civilized nation after another had found it necessary in organizing the medical departments of their armies to give more than twice as many general officers as is sought for in this bill now desired for the better organization of our Medical Department. Will you forget, and will the country forget what occurred at Chickamauga under that dear old general officer, Brooke, the good old American soldier, but who had about as much knowledge of typhoid fever as a Kamchatkan has of the internal constitution of the ecumenical council? You may remember that one-quarter of his entire command had typhoid fever, that nearly a thousand picked, healthy, strong, fresh, young men died of typhoid fever in that camp. Why? Because the medical officer in charge had no rank; because the line officer in charge disregarded the earnest, repeated recommendations of the medical officers who were without rank. That is why, and the young men died like flies. The medical officers made the right recommendations, but the officers of the line could plead as an extenuating circumstance that they were entirely ignorant of what would happen if they disregarded these orders. The line officer is left responsible for the health, without any moral or ethical responsibility, and can not be punished under the organization. If a line officer could be held before a military court-martial when men died under his command, it would be a far better method of organization.

"I want to say to you briefly that I believe now that the committees of Congress have at last understood that this desired organization of the Medical Department of the Army was for the sole patriotic purpose of saving the lives of the American soldiers, and the responsibility is now on the members of that committee, and on the Senate and House. I believe they will discharge their responsibilities wisely and well, if you give them proper attention."

DINNER AT ARMY AND NAVY CLUB

In the evening a dinner was given at the Army and Navy Club for the General Medical Board and members of the State and County Committees, Dr. Franklin Martin being toastmaster. Dr. Edward P. Davis, of Philadelphia, responded to the toast, "The President, our Commander in Chief," as follows:

"These are stirring days, and days of manpower. And it is of peculiar significance to citizens of these United States that today the most powerful man in the world is the President of this Republic. And one may well ask, 'On what food hath this, our Cæsar, fed, that he hath grown so great?'

"We are men of education, and as such, to us the development, the personality, the character, of Woodrow Wilson are, aside from presidential interest, of surpassing importance. He has fed upon education. There was, to begin with, the healthy child, the brain fibered in faith, bred in plain living and high thinking. But this education was peculiar, and in no small degree is his present prominence due to that.

"He was educated especially by his father, and there was a peculiar and most beautiful relationship of the influence of the older upon the growing mind. He has often said that he was allowed to make no statement the accuracy of which he could not demonstrate by reference to a book; and in dining with him he has remarked that owing to this habit of his father, at the conclusion of a meal, where conversation was had with the children, the dining room looked like a book shop; for if a child made a statement and the father challenged it, if the child could produce a reference proving the statement, he stood acquitted. The accuracy of his knowledge, which has surprised those who deal with him, is due largely to that method of education. His literary style was the constant subject of his father's care and training, and the father instilled into this lad the passionate love for the people of these United States. With a desire to know history and statesmanship, and those factors which led to the founding of the country and to its extraordinary growth, and coupled with accuracy of knowledge and power of expression, came his natural desire to voice his thoughts. The speeches of John Bright were his early study, and he has often told me of getting the key to his father's church on week days, going in and mounting the pulpit, and there declaiming John Bright's and others' speeches. And are you then surprised that he has taken as his creed of statesmanship the words in which Bright expressed the sum of his political wisdom:

"'When hopes fail, turn to the people.'

"He has changed, in my friendship with him of forty years, less than any man I know. He has grown by development, by accretion of knowledge, by strengthening of power, but he was in his college days a great democrat. His friends were the men of mind and heart, not of power or place or wealth. It was said of him then, as can now be said, nothing human is foreign to him, for he was the most human of us all, in love of humor, in friendship, in everything which pertained to us all; and added to that, the power of reason, the gift of expression, the utter carelessness of the little things, as to whether he stood high or low in the class—he was the man, the human fellow, dear friend.

"This man, then, by his steady process of evolution demonstrates today the value of education as does to my knowledge no other living man. And is he not to us, as educated men, an inspiration — is not his development, I mean — an inspiration for our sons and those who may come after us?

"There is another side, known possibly to few; and that is the side of tender affection, of firm and abiding friendship, and of passionate faith in those to whom he has given his heart; solicitous for others and thinking little of himself. And it has been

lately a revelation that this schoolmaster, this son of a Presbyterian parson, this man who was slow possibly at times because he knew more than his critics and saw farther, that this man should suddenly develop power. And when on the first anniversary of this war he thrilled the world with the statement that this Republic is now in a position where, under the guidance of Almighty God, it will exercise for the bringing of justice on earth, power without limit. And the world will find that the blended races of our great country will furnish mettle with which to fight the Hun. And one may answer the President, as he called for unlimited power —

"Strike with the sledge of Justice
On the anvil of the Lord;
He has heated hot His furnace,
He has opened wide His forge,
He is burning out the dross from men
With sacrifice and pain;
He has welded there a bar of steel
That peace may come again.
He has given him the fashioning,
The temper, and the edge,
Beat out the sword of righteous wrath
With Justice' fateful sledge."

Speeches were made by Surgeon General Gorgas, Admiral Braisted, Major F. F. Simpson, Mr. John G. Bowman, Colonel Frank Billings, Major W. D. Haggard, and Major W. W. Keen. Major Keen said:

"The two finest things I have heard lately are, first, what the President of the United States has said we must do: 'We must exercise force, *force*, FORCE, to the limit.' And the second, the Secretary of War has said we must raise men without limit.

"When I think what our brave allies have done; when I remember that Britain, with but 45,000,000 people, has put 6,000,000 men into the army; and France, though we haven't the figures, certainly has done as well; when that splendid British and French line, with the little help we have been able to give, have stood with their backs to the wall, and have resisted the attacks of the Hun, I am filled with the utmost admiration for what they have done. No finer an exhibition of bravery, of courage, of self-sacrifice, has ever been seen [turning to the British officer present] than your British soldiers have made.

"And where do we stand? We have 105 millions or more, and if we are to put into the field in proportion to what Great Britain has done, we should put in 15 millions; and I trust that will be the minimum that we will be willing to offer in the cause of civilization and of justice.

"You do not forget, I am sure, that the name of 'Hun' has not been given to the German by us. In 1900 when the Kaiser sent his troops to China, during the Boxer rebellion, what did he say to his troops? 'Take no prisoners; give no quarter; be more terrible than Attila and his Huns!' He gave the name of 'Hun,' and they have bettered his instruction. They have not taken prisoners. They have not given quarter, even. All the barbarities we have heard that have been perpetrated by Germany I could not believe at first. I had warm German friends, whom I appreciated and thought well of. But the evidence to me from personal knowledge, my friends, has been absolutely convincing, and I do not believe there is any atrocity that has been told us that has not been true.

"And what is more, they are debasing their own people. You know today, and I know, from irrefutable testimony, that they are debauching their own women and that the next generation of Germans will be largely a generation of bastards. Shall we not fight — fight to the death — against such barbarities, against such cruelties?

"There is but one thing for us to do, gentlemen. To answer the President of the United States, and use force, force to the limit. Force, until we have victory. And there is one comfort that I always have, even in the dark days we are passing through now. I do believe in the existence of God. And I do not believe that it is in the plan of Divine Providence that the whole world shall be ground under the heel of the barbarous Hun!

"The other day I saw in a circular something that impressed me greatly: 'The Inspiration of Disaster.' Think of it! We may come, gentlemen, to the days, even now, when disaster may come to our brave allies, and to our own brave boys on the other side. But the inspiration of disaster will be ours, and we will swear by the Almighty God that nothing shall intervene between us and victory."

ANNUAL MEETING OF GENERAL MEDICAL BOARD

HELD IN WASHINGTON, MAY 5, 1918

After roll call for members of the General Medical Board, the Council oath of office was administered to those present who had not previously taken the oath.

DR. FRANKLIN MARTIN, chairman: "This is the annual meeting of the General Medical Board of the Council of National Defense. We have with us as guests, members of the State Committees of the Council. Before proceeding with the regular business of the morning, I wish to introduce to you a man who is not a physician, but who is in the United States Senate and is on the Military Affairs Committee of the Senate; one who has listened to the arguments of some of us in regard to the feasibility of increased rank for medical officers."

SENATOR SUTHERLAND, of West Virginia: "I know that this body is held for business purposes, gathered together in connection with the Council of National Defense in order to prepare for entrance into service a larger number of physicians throughout the country. Upon you is laid a very important service. I don't know of any body of men in the country who are sacrificing more for the good of the country than you doctors and surgeons. I have listened with great interest and profit to the discussions before the Senate by your able representatives who have appeared before the Military Affairs Committee, including the distinguished gentleman to my left, General Gorgas, and those who assist him. I have been very much impressed with the justice of the claims of the medical profession for increased rank at the hands of the Government. So far as I am able to do so, I will do what I can to secure that recognition. I believe too, that the Committee on Military Affairs, while I can not speak for them except as an individual, yet I believe the feeling as expressed in the committee is favorable to greatly increased recognition."

SURGEON GENERAL GORGAS: "It is needless to say how extremely gratifying to all of us is the message Senator Sutherland has just given to us. It is probably the most important measure that is now under consideration for the efficiency of the Medical Department. I would like to impress upon Senator Sutherland that the Reserve Corps in war makes up ninety-odd per cent of our department, and that this bill entirely affects the Reserve Corps. We think that we have given very good reasons for the bill as it stands and we hope it won't be modified too much."

The Chairman, DR. FRANKLIN MARTIN, before reading his annual report called attention to the fact that "while the General Medical Board was not authorized and did not come into existence until April 6, 1917, these large groups before me, the State Committees, have been in existence for two years and the work carried on before April 6 of last year was carried on by practically the same men who afterwards became the members of the General Medical Board."

DR. MARTIN detailed the routine procedure with regard to matters brought before the General Medical Board. They were first discussed before the General Medical Board and passed upon at a meeting of the Executive Committee. "When a matter has been considered by the Executive Committee, it is then a matter of reference first to the Advisory Commission and then to the Council. If the matter is there approved, it is sent where it belongs for execution. The General Medical Board has met at least once a month during the year. The Executive Committee meets whenever there is anything of importance to consider."

Reports of committees, in abstract, are included in the chairman's report to be found in the preceding pages.

Clinical Congress
American College of Surgeons

NINTH ANNUAL MEETING
NEW YORK CITY
OCTOBER 21 TO 26, 1918

COMMITTEE ON ARRANGEMENTS

J. Bentley Squier, Chairman

New York City

Hugh Auchincloss
Clarence G. Bandler
S. W. Bandler
John A. Bodine
LeRoy Broun
Leo Buerger
W. E. Caldwell
Alexis Carrel
Charles H. Chetwood
James B. Clemens
Cornelius G. Coakley
Martin Cohen
William B. Coley
Royal S. Copeland
Edwin B. Cragin
Asa B. Davis
John Douglas
Charles N. Dowd
William A. Downes
John W. Draper
Charles A. Elsberg
John F. Erdmann
Ernest Fahnestock
Austin Flint
Henry W. Frauenthal
Eugene Fuller
Henry D. Furniss
Virgil P. Gibney
Charles L. Gibson
Charles Goodman
John A. Hartwell
Irving S. Haynes
William P. Healey
William T. Helmuth
James M. Hitzrot
Lee M. Hurd
Harry M. Imboden
George W. Kosmak
Adrian V. S. Lambert
Robert Lewis
Richard Lewisohn
James W. Markoe
Walton Martin
Francis S. Mathews
Joseph F. McCarthy
Willy Meyer
Seth M. Mulliken
Alfred T. Osgood
Wendell C. Phillips
John Rogers
Thomas A. Smith
Frederic E. Sondern
George D. Stewart
W. E. Studdiford
Alfred S. Taylor
Howard C. Taylor
Antoine P. Voislawsky
Charlton Wallace
George Gray Ward, Jr.
Wilbur Ward
John E. Weeks
Frederick Whiting
Royal Whitman
George Woolsey

Brooklyn

R. M. Beach
Eliot Bishop
J. Bion Bogart
W. F. Campbell
C. G. Crane
G. L. Deely
H. Beekman Delatour
Robert L. Dickinson
James M. Downey
Warren L. Duffield
Russell S. Fowler
F. C. Holden
Albert M. Judd
William Linder
S. H. Lutz
Joseph P. Murphy
John Osborn Polak
J. S. Read
Ray Sullivan
Walter Truslow
Luther F. Warren
J. S. Waterman
Richard W. Westbrook

EXECUTIVE COMMITTEE

George D. Stewart, Chairman

Cornelius G. Coakley
Martin Cohen
John Douglas
William A. Downes
Arthur B. Duel
C. A. Elsberg
John F. Erdmann
Charles L. Gibson
Frederick C. Holden
George W. Kosmak
A. V. S. Lambert
J. F. McCarthy
J. P. Murphy
Wendell C. Phillips
J. Bentley Squier
William E. Studdiford
Howard C. Taylor
Charlton Wallace
George Gray Ward, Jr.

CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

WILLIAM J. MAYO, M.D., President. ALBERT J. OCHSNER, M.D., Treasurer.
FRANKLIN H. MARTIN, M.D., Secretary-General.

PLANS FOR THE 1918 MEETING IN NEW YORK CITY

AT a meeting of the clinicians of New York City and Brooklyn, held on Tuesday evening, May 28th, at the Metropolitan Club in New York City, called together by Dr. J. Bentley Squier, Chairman of the Committee on Arrangements, definite plans were considered and adopted for the annual session of the Clinical Congress of the American College of Surgeons to be held in New York City October 21 to 26, 1918. The work of the committees appointed at that meeting has progressed so that the program of clinics and demonstrations for the week of the Congress is now well along toward completion and will be published in an early issue of this journal. On another page will be found a list of members of the Committee on Arrangements, together with those of the Executive Committee. Subcommittees having in charge the preparation of the clinical program have been appointed as follows:

General Surgery — George D. Stewart, Chairman; Ernest Fahnestock, Secretary.

Military Surgery — Charles L. Gibson, Chairman.

Orthopedic Surgery — Charlton Wallace, Chairman.

Gynecology — Howard C. Taylor, Chairman; George Gray Ward, Jr., Secretary.

Obstetrics — William E. Studdiford, Chairman; W. E. Caldwell, Secretary.

Laryngology — Cornelius G. Coakley, Chairman; Lee M. Hurd, Secretary.

Otology — Arthur B. Duel, Chairman; John R. Page, Secretary.

Ophthalmology — Martin Cohen, Chairman; H. H. Tyson, Secretary.

Urology — Joseph F. McCarthy, Chairman; C. G. Bandler, Secretary.

Laboratories — Frederic E. Sondern, Chairman.

X-Ray Demonstrations — Harry M. Imboden.

Surgical Research — William A. Downes, Chairman; Hugh Auchincloss, Secretary.

Finance — John F. Erdmann, Chairman.

Program — John Douglas, Chairman.

Publicity — George W. Kosmak, Chairman.

Brooklyn Committee — Frederick C. Holden, Chairman.

A WAR CONGRESS

The one important topic for consideration at the New York meeting will be War Surgery. The notable advances that have been made during four years of war will be summarized in the papers to be read by distinguished officers of the English, French and Italian armies and by eminent American surgeons who have seen active service in France, providing a program for the evening meetings that will surpass, if possible, that remarkable series of meetings at the Chicago session in October, 1917. A consideration of the newest methods in the treatment of fractures, infections, injuries of the brain and nerves, surgery of the chest, surgery in the reconstruction of disabled soldiers, etc., will provide some of the greatest symposia as to men and subjects ever presented at a medical meeting in this country.

GENERAL PLANS FOR THE MEETING

This will be the first meeting of the Clinical Congress under the auspices of the American College of Surgeons, the amalgamation of the Clinical Congress of Surgeons of North America and the American College of Surgeons having been perfected at the meeting held in Chicago in October, 1917.

The program of the Congress will follow closely that of previous sessions in that clinical demonstrations in the hospitals, medical schools and laboratories will occupy the morning and afternoon hours of each day, the evenings being

devoted to literary sessions. The plans of the Committee on Arrangements provide for a complete showing of the clinical facilities of New York City and Brooklyn in every branch of surgery, including gynecology, obstetrics, genito-urinary surgery, orthopedics, surgery of the eye, ear, nose, throat and mouth, together with special demonstrations in roentgenology, experimental surgery, surgical pathology, etc. It may be confidently assumed at the beginning that New York City and Brooklyn with their numerous large hospitals, medical schools, laboratories and well organized clinical facilities, will provide a program of unusual interest.

Headquarters will be established at the Waldorf-Astoria and McAlpin hotels. The ballroom, Astor Gallery, Myrtle and East Rooms, together with other large public rooms and foyers on the second floor of the Waldorf-Astoria have been reserved for the use of the Congress for its registration and ticket bureaus, bulletin rooms, etc. The ballroom will be used for the large general sessions, afternoons and evenings, cinematographic exhibitions, etc. Because of its large number of guest rooms, the Hotel McAlpin, under the same management as the Waldorf-Astoria, and located in the same block, will be able to take care of a very large number of visiting surgeons.

LIMITED ATTENDANCE — ADVANCE REGISTRATION

The popularity of these clinical meetings has proven so great that it has been found necessary to limit the attendance, thereby requiring advance registration. This plan has proven satisfactory at previous sessions of the Congress and will be enforced at the New York meeting, thereby assuring accommodations at the clinics for each one who receives a membership card. A survey of the operating amphitheatres, lecture rooms and laboratories in the hospitals and medical schools as to their capacity for accommodating visiting surgeons will be made and the limit of attendance will be based thereon.

To each member registering in advance will be issued a formal receipt for the registration fee, which receipt is exchangeable for a membership card at headquarters at the Waldorf-Astoria when registering upon his arrival in New York. Headquarters will be open on Sunday afte noon, October 20th, for the convenience of members arriving in the city on that day. The clinical program for Monday will be bulletined at headquarters on Sunday, and on the afternoon of each day there will be bulletined at headquarters a complete, accurate program of the clinics and demonstrations to be given on the succeeding day. Printed programs will be issued each morning containing the complete clinical program, witl announcements as to evening sessions, etc.

REGISTRATION FEE

A registration fee is required of each member attending an annual meeting, the receipts from registration fees providing the funds with which to meet the expenses of preparing for and conducting such meetings, so that no financial burden is imposed upon the members of the profession in the city entertaining the Congress.

SPECIAL CLINIC TICKETS

Attendance at all clinics and demonstrations will be controlled by means of special tickets, the number of tickets issued for any clinic or demonstration being limited to the capacity of the room in which the clinic or demonstration is to be given. The general rule will be that a member may have two tickets for each day, one for a morning and one for an afternoon clinic. For certain clinics where the accommodations are limited and the demand for tickets is heavy, it may be necessary to establish a rule whereby a member may have only one ticket for such clinic during the week.

The use of special tickets has proven an efficient means of providing for the distribution of members among the several clinics and ensures against overcrowding at any clinic. Special tickets will be issued each morning for the clinics and demonstrations to be held that day, a complete schedule of the day's clinics having been posted on the bulletin board on the afternoon of the preceding day, and a printed program distributed in the morning.